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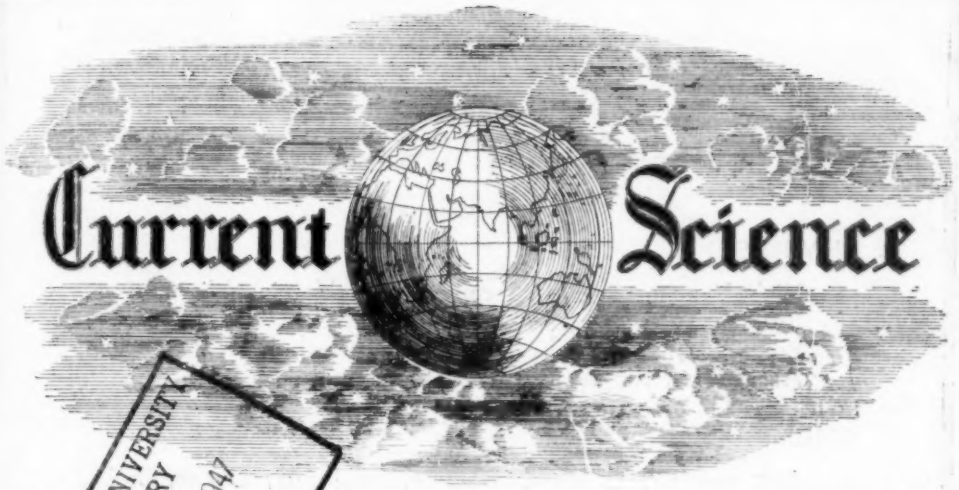

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(2) Nationality;

(3) Resume of previous experience in research with details of previous appointments held and emoluments;

(4) Salary expected;

(5) Minimum period for which they would be prepared to accept the appointment on a contract basis;

(6) The earliest possible date by which they could take up the appointment.

4. The Cotton Textiles Fund Committee are anxious to obtain the services of the most suitable person capable of both designing and planning and subsequently administering what they intend shall be the most up-to-date Research Institute of its kind. It is, therefore, essential that persons with considerable administrative and research experience only need apply.

5. Applications must reach the Secretary, Cotton Textiles Fund Committee, Hararwala Building, Wittet Road, Ballard Estate, Bombay, not later than the 30th April 1947.

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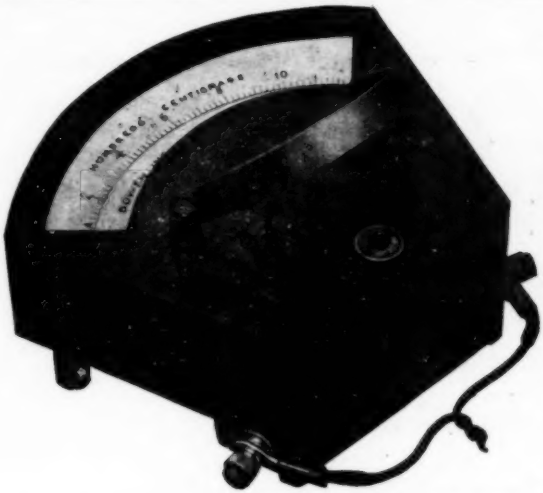

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CURRENT SCIENCE

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METALLURGICAL RESEARCH AND INDUSTRIALISATION*

IN the distant past this country was foremost in metallurgical industry and contributed much to human knowledge of metals and alloys. India was the first country to evolve the composition of some of the well-known alloys. Now in our own time too this country has the distinction of being one of the largest iron and steel manufacturing countries in the world. The Tata Iron & Steel Co., the Steel Corporation of India and the Mysore Iron and Steel Works have contributed to raising India to this place of honour.

During the years of the war, India's steel production reached 2 million tons per year. Other metallurgical enterprises such as the manufacture of alloy steels, ferro-chrome, ferro-manganese, ferro-silicon and aluminium, were also started. But the position is not one for complacency.

The Imperative Need for a Prosperous Metallurgical Industry

Although we possess a sizeable iron and steel industry, we are backward in other aspects of metallurgical industry, which cover a very vast field. We are entirely dependent on other countries for high-speed tool and alloy steels, aluminium, magnesium, various ferrous and non-ferrous alloys and their products. In consequence, engineering industries, the manufacture of internal combustion engines, electrical industry, ship-building, aircraft, chemical industries and several other important industries, which depend on metallurgy for the supply of the necessary constructional material, have not grown in the country. If India is to embark on any kind of industrialisation,

* Extracts from an Address delivered by the Hon'ble Mr. C. Rajagopalachari, on the occasion of the Foundation-Stone Laying Ceremony of the National Metallurgical Laboratory, at Jamshedpur, on 21st November 1946.

and achieve success in a reasonable measure, high priority must be given to the proper establishment of metallurgical industries, on an adequate scale. The mineral wealth of the country must be fully exploited. India is not far behind the richest countries in the world in respect of minerals of economic value. Not only clay, limestone, iron ore and gypsum but bauxite, chromate, manganese ore, rutile, monazite, and ilmenite are available in plenty. All these valuable minerals should be worked up for the growing needs of the country and not just exported as hitherto. During the past 30 years India's export of manganese ores ranged from one-fourth to more than half of total world-production. And this mineral is almost entirely absorbed in iron and steel industry.

It has been estimated that in the near future hydro-electrical energy at the rate of over 4 million K.W. will be produced as a result of various hydro-electric projects. A large part of this energy will be available in the vicinity of the raw mineral resources of the country. Electro-metallurgical and electro-chemical industries based on electricity thus available at low cost can play a great role in the industrial life of the country. Our immediate requirements 20,000 tons of aluminium, 5,000 tons of magnesium, 15,000 tons of copper, 60,000 tons of electric furnace steel per year, and large quantities of other electro-thermal products like alloy steels, ferro-chrome, ferro-manganese, ferro-silicon, graphite and carborundum, can be based on this cheap electrical energy.

Scientific Research—an Essential Prerequisite to Progress

For the organisation and progress of industries, scientific research of a high order is an essential prerequisite. Taking the lowest view of the matter, scientific research pays. It helps to increase efficiency of means used to lower cost of production and to evolve new processes and new products. All experience in recent times show that research, pure as well as applied, helps industries earn very handsome dividends. It is no good leaving things entirely to the government or to anyone else. Excepting in a few isolated cases like the Tata organisation and perhaps the tea and jute interests of the country, industries in India, big and small, are not yet alive in adequate measure to the advantages of scientific research. Among the many factors that have been responsible for this state of affairs, there is the vicious circle that we have to face in all progressive endeavour. Without prosperity industry cannot afford research, and without research industry cannot prosper. This circle must be broken, somehow or other, and soon. The responsibility, therefore, falls on Government to help scientific research in the cause of national progress. The Council of Scientific and Industrial Research has, therefore, founded National Laboratories.

Function of the National Laboratories

It is not intended that these National Laboratories should take upon themselves the functions properly belonging to individual or collective industrial concerns in respect of research. The nature of research work intended to be carried on in the National Laboratories is of the kind that is not ordinarily covered by the work of research that can be conducted by industries themselves, by individual concerns or on a co-operative basis. The Government has to be on the watch for new developments in scientific knowledge which may be of economic or social value to the nation. When such developments offer sufficiently attractive openings, the industries will in most instances probably be ready to take them up and develop them. But the Government has to take the initiative, whenever possible, in collaboration with the particular industry, in exploring new ideas on an adequate scale and, in the event of successful development, taking appropriate steps to secure the widest possible application of the results. Applied scientific research has often necessarily to be carried out in a big institution. The National Metallurgical Laboratory will work in the closest collaboration with all the existing research institutes. While carrying out such tasks as devolve on it in connection with metallurgical research, it will endeavour to promote research by the industry itself, individually, or through co-operative organisations, so that the metallurgical industry of India can soon come to rely upon its own strength and initiative. The metallurgical and other industrialists of the country will give the fullest support to this most important National Laboratory.

Science—A Great Unifying Force

We are on the threshold of a future full of trials, heavy duties and great rewards. In the trials and in the duties that await us, scientists and engineers of the country have to take a very large part. They have great opportunities for service, far greater than they had ever before. They will see the whole country rallying round them, howsoever apparently divergent be the views and aspirations of political or other groups. Science is a great unifying force and may save us where religion as practised has not only not availed, but seems to hinder and divide.

THE NATIONAL METALLURGICAL LABORATORY, INDIA

By G. P. CONTRACTOR

(Council of Scientific and Industrial Research, Delhi)

IT was during the last war that the Government of India realised that only planned industrial research on the many problems of the chemical, metallurgical and engineering industries could harness the country's vast resources for the prosecution of the war. This realization was given effect to by the creation of the Board of Scientific and Industrial Research in April 1940 and of the Council of Scientific and Industrial Research afterwards. The Council was established to meet the long-felt need of a Central organisation for a co-ordinated prosecution of scientific and industrial research. As the main result of the unbounded energies of Sir S. S. Bhatnagar, Director of the Department of Scientific and Industrial Research, that it was made possible to obtain from the Government of India more than a crore of rupees for the establishment of a number of Research Laboratories to be sited in different parts of India. One of these, namely, the National Metallurgical Laboratory, is to be built at Jamshedpur.

In order to ensure the progress and expansion of the metallurgical industry it was decided by the Council that a National Metallurgical Laboratory be established in India. Accordingly, a Laboratory Planning Committee, under the Chairmanship of Sir J. J. Ghandy, Director, the Tata Industries, Ltd., was constituted to formulate a scheme. The author was appointed the Assistant Director to assist the Planning Committee in the preparation of detailed plans, and Messrs. Ballardie Thompson and Matthews of Calcutta were appointed the Architects. A tentative scheme was first circulated in 1945. This scheme was later on drastically altered on the basis of the suggestions and comments received from research workers of repute in various countries, and principally on the basis of the funds available with the Council. The final scheme recently prepared was approved on the 17th September 1946 by the Governing Body of the Council of Scientific and Industrial Research, and the Foundation-Stone of the Laboratory was laid on the 21st November 1946, by the Hon'ble Mr. C. Rajagopalachari, Member for Education and Arts, Interim National Government.

As stated earlier the Laboratory will be located at Jamshedpur which is the centre of modern metallurgical industries in India. The Tata Industries, Ltd., have generously placed at the disposal of the Council a very suitable site for the construction of the Laboratory. Services, such as electricity, water, gas, sewage and effluent disposals, are available close to the site.

The Laboratory when completed will cover all aspects of metallurgical research, both fundamental and applied, and will also carry out research on ores, minerals and refractories as applied to metallurgy. The preparation of minerals and ores and the smelting of the latter are so definitely a part of the development of the country's metallurgical industries that facilities for mineral research have been provided at the Laboratory, complete with pilot plant equipment for semi-commercial development.

As the metallurgical industry is one of the biggest consumers of refractories, research on this subject has also been associated with that on metallurgy, and that the work on metallurgical furnace design might also be undertaken. Work on refractories will be greatly facilitated by the presence of the ore-dressing and minerals research section with its specialized laboratory and pilot plant assemblies.

In consequence, provision has been made in the final plans of the National Metallurgical Laboratory, for administration, including statistics, library, museum, lecture theatre, etc., chemical analysis, physical chemistry, physics as it affects metallurgical problems, the examination, preparation and smelting of metallic ores, the melting, heat-treatment and working of metals and alloys, research into the structure and physical properties of metals and alloys, the electro-deposition and surface treatment of metals, and research on refractories. Facilities will also be provided for the application of research results to commercial operating conditions and for the study of such conditions as they affect the quality of the products and the efficiency and economy of commercial production. The National Metallurgical Laboratory will work in close collaboration with the other laboratories of the Council, particularly on long-term research of a fundamental nature.

Broadly, the work of the National Metallurgical Laboratory will be divided into the following divisions:—

1. *Physical Metallurgy Division* including thermal, electrical and magnetic tests, experimental heat treatments, pyrometry, X-ray analysis, radiography, optical properties, application of ultrasonics to metallurgical problems, etc.

2. *Metallography Division* including electron and normal microscopy, macroscopy, inclusions study, experimental foundry, making, mechanical working and heat treatment of metals, physical testing of metals at various temperatures, etc.

3. *Chemical Metallurgy Division* including extraction and refining of metals from their similar materials (ore-dressing and mineral beneficiation).

4. *Inorganic Chemistry Division* including analytical chemistry of metals, alloys, ores, refractories, slags, fuels, etc., study of gases and inclusions by vacuum fusion and other methods, micro-analysis, etc.

5. *Physical Chemistry Division* including electro-metallurgy, study of corrosion and protection of metals, surface treatment of metals, polarography, spectrography, study of slag-metal relationship, chemical microscopy, thermo-dynamics, radioactivity, colorimetry, electro-chemistry, electrolytic production of

metals, determination of pH and its application, general electro-chemistry, etc.

6. *Refractories Division* including study of moulding sands, binders and auxiliary materials, thermal and other physical characteristics, physical properties at various temperatures, petrographical study of minerals and refractories, etc.

7. *Survey and Intelligence Division* including survey of raw materials, library, research and technical information service, translation service, scientific liaison, museum, publication and publicity.

Summarily, the Laboratory is meant to function as an up-to-date research centre where knowledge of the fundamental science of physics, physical and inorganic chemistry, metallography, engineering, etc., will be utilized to solve the problems which confront the ferrous and non-ferrous masters and metal fabricators to-day and are expected to confront them even more in the future when competition from foreign countries will have to be met. The Laboratory is also meant to function as a clearing house for information. The Laboratory will give facilities to a number of scholars to an advanced course and will train them in the application of scientific methods to metals industries, so as to enable them to take charge of technological duties in the works. To help and encourage industrialists in the solution of their problems, facilities will be provided at the Laboratory by establishing Fellowship System, first inaugurated at the Mellon Research Institute, Pittsburgh.

The Laboratory will consist of a Main Building housing administrative offices, research laboratories, library, lecture theatre, museum, etc., and a Technological Block comprising large workshop-type laboratories or bays associated with control rooms for semi-commercial scale operation. The Main Building will have three floors. The administrative section is centrally located on the second floor. The actual working floor area on the first floor is approximately 26,000 sq. ft., with an equivalent space on the ground floor and about 8,600 sq. ft. on the second floor. The Technological Block providing a working floor area of about 28,000 sq. ft., has been situated to the south of the Main Building and connected to it by covered ways. The individual laboaratories and the administrative section in the Main Building will be air-conditioned by refrigeration system.

The total cost of construction and equipment of the Laboratory is estimated to be Rs. 42,80,000. Buildings, services, air-conditioning, heavy electrics, etc., are estimated to cost Rs. 25,00,000 and for equipment a provision of Rs. 17,80,000 has been made. The recurring expenses in the initial stages are approximately estimated at Rs. 6,00,000.

HYDERABAD ENGINEERING STANDARDS COMMITTEE

IN order to bring the P.W.D. Officers together for the purpose of discussion of their problems and programmes and to benefit by personal contacts, a Conference of the P.W.D. Officers was held for three days in Hyderabad. It was presided over by the Hon'ble Nawab Zain Yar Jung Bahadur, the P.W.D. Member, and was attended by the Chief Engineers, Superintending Engineers and all the Executive Engineers and Divisional Engineers. They visited the Engineering Research Laboratories on the 14th of December 1946 when the various experiments regarding irrigation, building and road researches were shown to them. The next day Dr. S. P. Raju, Director of Engineering Research, moved the following resolution at the Conference :—

"*Resolved* that in view of the importance of accurate determination of strength of materials and their economical use in construction, an Engineering Staandards Committee be formed to work in collaboration with the Engineering Research Department. with the programme of collection of the different engineering materials of the State, their systematic testing and the drawing up of the standards of specifications."

In explaining the need of such a Committee Dr. Raju stated that the fact of American engineers constructing some of the biggest buildings, dams and other engineering structures in the world was due to their confidence in their knowledge of materials and methods of construction derived by extensive testing and standardising of specifications. He referred to the work of the American Society for Testing Materials (A.S.T.M.), American Society of Highway Officials (A.S.H.O.) for Road Standards, Bureau of Reclamation for Irrigation Standards and then to the British Standards Institution.

He was glad that the Government of India had decided to set up an Indian Standards Institution with the object of evolving national standards in respect of structures, materials, operations, practices, etc. He referred to the speech of the Hon'ble Member in which he had said : "In order to get the greatest good out of engineering research there must be a close co-ordination between engineering practice and engineering research" and stressed the need of a body like the Conference of P.W.D. Officers to be associated with researches on materials and their standardisation.

The Hon'ble Member strongly supporting the resolution mentioned some of the big things he has in view for engineering progress in Hyderabad which would be needing the help of such a Standards Committee and stated that the Research Laboratories and the P.W.D Officers may thus co-operate in a work of great importance and be linked with the National Body of the Indian Standards Institution.

The Proposals were unanimously accepted.

Hyderabad has the good fortune of carrying an Engineer-P.W.D. Member who can, not only administer the Department but also enter fully into its technical details.

A BIO-ÆSTHETIC PLAN FOR INDIA

By M. S. RANDHAWA, I.C.S.

JUST as we are planning the development of industrial and agricultural resources of our country we should also have a national plan for encouraging the growth of fruit, timber and ornamental trees. In drawing the plan we have to consider the choice of trees for each climatic zone of the country and also take into view the soil and irrigation factors. We have also to clarify our ideas regarding the choice of trees for various purposes, *e.g.*, planting road-side avenues, city roads, canal banks, public parks, platforms in railway stations and compounds of private houses. We have to assign ornamental flowering trees, shade trees, timber trees and fruit trees to places where they can best fulfil their function. At present we see the irritating spectacle of fruit trees being grown indiscriminately in the compounds of houses and, timber trees in public parks and city roads.

The Plan

In brief we may sum up our tree plantation plan for India as follows:—

1. *Bio-aesthetic planting* for compounds of private houses, dak bungalows, banks, hotels, universities, colleges, schools, public offices, town roads, public parks and platforms of railway stations. For these places we should select trees with beautiful flowers and foliage to beautify them and to give pleasure to the people. Kachnar, pink cassia, erythrina, millettia, amaltas and gold mohur come under this category.

2. *Roadside avenues of our national, provincial and district highways.*—The sole criteria for selection should be shade plus economic utility. For this purpose, trees which yield timber, fruit and are also shady should be selected such as mahua, mango, tamarind, neem and sheesham.

3. *Canal roads.*—We should plant all canal roads with fruit trees like mango, jaman, kathal, etc. The stones of varieties like langra, dussehri, sufeda and fajri, yield excellent fruit trees which are better than the desi mango. There are thousand miles of canal roads which can be planted with fruit trees thus adding a valuable source of vitamins to the deficient dietary of our people.

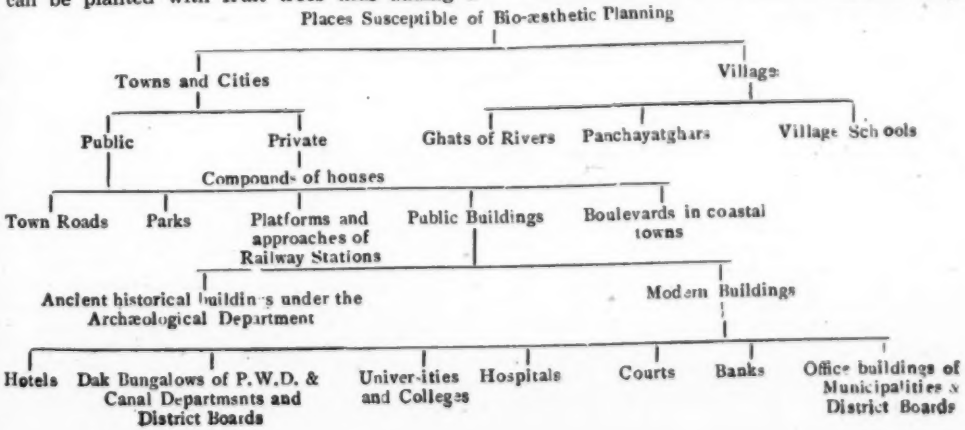
4. *Village plantations.*—Fruit, timber and fuel are the main requirements of villages. Fruit trees like mangoes, lemons, papaya, kathal and sweet-limes are recommended for planting in the compounds of their houses, phulwaris and along the bullock runs of their wells fitted with persian wheels. They should be encouraged to plant bakain and mulberry trees in the compounds of their cattle sheds.

I

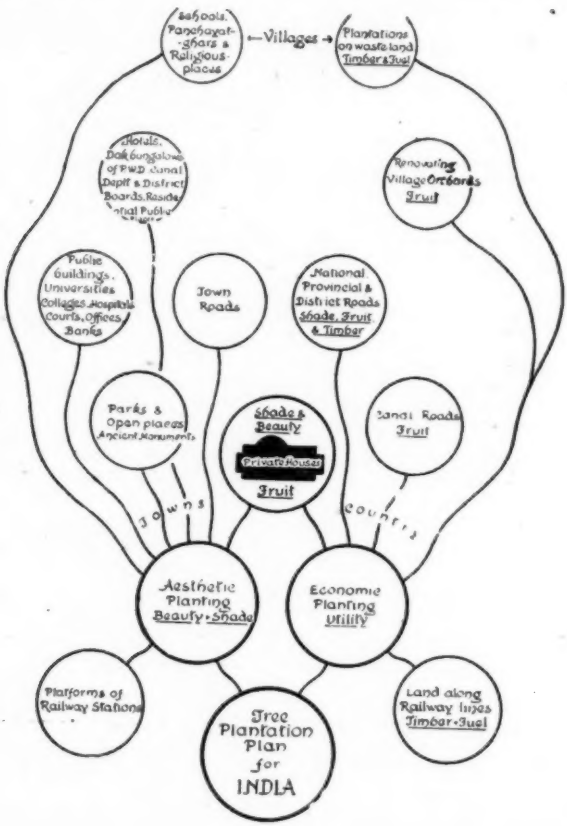
A BIO-ÆSTHETIC PLAN

We are indebted to Professor Lancelot Hogben for the term "bio-æsthetic planning" which may be defined as conscious planning of the flora and fauna with the object of beautifying the country. Bio-æsthetic planning embraces both the animal and plant sciences, Botany and Zoology, and may be further defined as planned ecology of living beings from the artistic and æsthetic point of view. It includes the plantation of ornamental flowering trees along city roads, in parks, public places and compounds of houses both in towns and villages and development of National Parks for the preservation of beautiful, non-carnivorous animals, and creation of bird sanctuaries. The object of our bio-æsthetic plan for India is the encouragement of plantation of selected ornamental flowering trees in our towns and villages, protection of beautiful hamrless birds like wild ducks, egrets, geese and Sarus cranes by legal declaration of some of our big Jheels (lakes) as bird sanctuaries, and preservation of graceful animals, which are being ruthlessly exterminated, such as black-buck, blue bulls, sambhars and spotted deer in National Parks and zoological gardens in the vicinity of our big towns.

Public places which belong to the community as a whole rather than individuals should claim preference in bio-æsthetic planning. Larger number of persons, especially those who are unable to afford private gardens of their own will thus be able to enjoy the sight



of beautiful flowers. Public parks and squares, public roads, platforms of railway stations, compounds of hospitals, universities, colleges and schools, ancient historical buildings under the supervision of the Archæological Department, compounds of courts, office buildings of municipalities and district boards, and dak bungalows of the Public Works Department, Canal Department and District Boards are places in towns which are susceptible of bio-æsthetic planning and should claim preference in our programme for the beautifying of our towns and cities. Proprietors of hotels and banks, and owners of new bungalows should also be encouraged and given all assistance in the planting of ornamental trees.


Schools, Panchayat-ghars & Religious places
Villages
Plantations on waste land Timber & Fuel
Hotels, Dak bungalows of PWD, Canal Deptt & District Boards, Roads
Renovating Village Orchards Fruit
Public buildings, Universities, Colleges, Hospitals, Courts, Offices, Banks
Town Roads
National Provincial & District Roads Shade, Fruit & Timber
Parks & Open places, Ancient Monuments
Shade & Beauty
Private Houses
Fruit
Canal Roads Fruit
Towns
Country
Aesthetic Planting Beauty + Shade
Economic Planting Utility
Platforms of Railway Stations
Tree Plantation Plan for INDIA
Land along Railway lines Timber + Fuel

TOWN PLANNING AND BIO-ÆSTHETIC PLANTING

Town planning and bio-æsthetic planting go hand in hand. Orderly and planned planting of ornamental trees can be seen to its best effect in new towns with wide roads flanked by shady footpaths, well-laid-out public parks and squares, rather than in congested old towns with narrow crooked streets. Our old towns offer little scope for bio-æsthetic planting. Firstly they contain no open places suitable for plantation and secondly their streets and roads are too narrow.

OUR OLD TOWNS

Town planning is a precondition of bio-aesthetic planting. We have allowed our towns to develop without any plan or order like mushrooms on a dung-heap. In our country *laissez faire* has really gone amock and the results have been most unfortunate. Ugly ill-ventilated houses joined together in monstrous piles along narrow, crooked lanes—that is how our ancient towns like Lahore, Lucknow and Benares appear to an outsider whose eyes are accustomed to Western orderliness. An aerial view reveals them as pieces of a jig-saw puzzle, mixed up in a crazy pile. And not a patch of green in these prison-like piles of masonry. These houses may have been suitable in mediæval, insecure times when security was the guiding principle in our domestic architecture rather than ventilation, but at present they appear anachronisms and fossils of a social and economic order which disappeared long ago. In these old towns, the so-called native quar-

ters and bazars of the Anglo-Indian Sahib, we see a reflection of our disorderly and undisciplined social and economic life. They may appear romantic to foreigners who come to our country in search of oriental mysticism and magic, but are certainly unfit for the growth of a healthy nation. It is time that we realize that we had enough of these smelly streets. The younger generation must be educated in a new mode of living. We must improve the environment which surrounds the individual in our towns.

Improving Old Towns

A very pertinent question arises about the fate of these old towns. What should be done with these ancient insanitary slums? Some would recommend wholesale demolition. But that is an extreme view, idealistic rather than practicable. These old towns are in need of drastic surgery. We must decongest these old residential areas by compulsorily acquiring suitable central housing areas, and after demolishing the ugly houses thus acquired, we should develop parks and open places in the sites thus vacated. Improvement Trusts have done useful work at Cawnpore, Lucknow and Allahabad, but the rate of progress is snail-like, and painfully slow considering the tempo of modern life and our requirements. In the parks thus made, bathing tanks should be constructed for the enjoyment of citizens in hot weather and incidentally for irrigating the trees and lawns.

As regards the growth and expansion of our towns, control and planning are very essential. All the available land in a radius of three miles or more from the inhabited area according to future needs should be compulsorily acquired by the municipalities and planned into residential areas with commodious plots for houses and wide roads. The garden suburb should be our ideal in this hot country for vertical development is unsuitable considering the summer heat and flats are positively uncomfortable in hot months. Moreover the development of motor transport has greatly facilitated horizontal and peripheral development of towns. So far as possible the growth of these gardens suburbia should be planned in a concentric manner, as this will mean economy in fuel consumption for motor vehicles.

With the planned development as outlined above for our old towns, a good deal of improvement is possible. It will not only provide suitable houses for the man with moderate means, but will also provide a check for the unbridled anti-social activities of the site-gamblers, rack-renters and slum-builders. It is very essential that the Government calls a halt on the process of slummification so that the activities of chawl-builders who are creating problems for the future are curbed, and the colossal waste of wealth of the country on these rows of ugly houses is stopped. With evisceration of slummy quarters, development of parks and tanks in decongested areas, and controlled development in the suburban areas we can make our old towns also fairly attractive.

New Towns

Towns develop along the lines of communications and serve as production or distribution centres. Our old towns have developed along the banks of rivers which were the main channels of communications in the past and served as distributing centres where the villagers exchanged their agricultural produce with handmade articles manufactured by the artisans of towns. Under the stress of modern industrial development with machine production and rapid means of communications by means of railways and motor vehicles, the old distributing town along the river bank stands as an anachronism. New manufacturing towns will arise in course of time near the source of raw materials, though not to the same extent as in young developing countries like the United States of America and the Soviet Union. Like their Pittsburgh, Detroit, Magnitogorosk, we too will have big manufacturing centres in course of time and Jamshedpore of Tatas is a case in instance. With development of hydro-electric projects industry is bound to spread, but more in the vicinity of existing towns rather than in new sites.

The Garden City

So the problem arises, what should be our ideal in this new town development? The Garden City should be our ideal and the Welwyn Garden City in England, and the Model Town of Lahore provide an example which may be profitably followed in the development of new population centres.

The noisy clanking tram-car with its ugly rails spoiling the streets should be definitely banned in these new towns. With electrification which will follow hydro-electric schemes, trolley-buses will be most suitable for transporting people to the places where they work from their homes in garden suburbs. For our city of the future, Le Corbusier model with many-storeyed offices and factories linked with the garden suburbs by means of bio-æsthetically planted roads, will be very suitable. People will work in the production hub of the city during daytime and will scatter again in the garden suburbs in the evening enjoying their life in healthy, quiet, noise-free and dust and smoke-free surroundings.

Bathing Tanks

Public bathing tanks should form an essential feature of these new towns. People can enjoy themselves in these tanks during summer and their waste water can be used for irrigating the public parks and gardens, which should be planted with ornamental flowering trees. Canals where available can also serve a useful purpose and also provide excellent opportunities for scenic planting and beautifying the towns.

Road Plan and Plantation Plan

For our towns we are not only in need of 'Road Plan' for traffic but also 'Plantation Plans'. For every town of importance a 'Plantation Plan' should be drawn and rigidly adhered to. For new roads it is comparatively easy to plan plantation of unfamiliar flowering tree. and it is the old roads which present a problem. The wholesale cutting of existing trees will render them shadeless,

Hence the only practical approach is replacement of dead, decaying and old trees according to a plan, and removal of trees planted within two to three years. Once a plan is made, it should be rigidly followed not only in new plantations but also in replacements.

Choice of Trees

While shade and economic utility should be the criteria for selecting trees for national, provincial and district roads passing through the countryside different types of trees are required for town roads. For roadside avenues in towns and cities, shade and beauty are the sole criteria which we should consider while selecting trees. Unfortunately, there are very few trees which combine shade with beauty of flowers, for the large majority of our flowering trees are deciduous. Where space available is so limited and only one row of trees can be grown on each side of the road flowering trees like Gul-mohar, Amaltas, Jacaranda, Erythrina and Spathodea may be grown alternating with shade trees like *Eugenia operculata*. Choice should be restricted to one species only for each street. Very tall trees like Eucalyptus and Millingtonia, and trees with spreading crowns like Banyan, are unsuitable for town roads, for they interfere with electric wires. Medium-sized trees like *Eugenia operculata* and Pakur (*Ficus infectoria*) which are extensively grown in New Delhi, are ideal for shade while for beauty we have a large number of trees to choose from.

Double Avenues for Cities

Double avenues of trees are a necessity in big cities, where wide roads are available. In an ideal road for a traffic centre of the metropolis provision should be made for fast-moving traffic such as motor cars and lorries and slow-moving traffic such as horse-drawn vehicles, bullock carts and bicycles. A road divided into four sections for slow and foot traffic on each side separated by islands planted with grass and shrubs in the middle and flanked by footpaths for pedestrians, should be our ideal. We recommend double avenues of trees on outer sides of the footpaths, an outer row of shade-trees and an inner row of ornamental flowering trees. The outer row should be composed of ever-green shade trees with dense foliage, such as Tamarind (*imli*), *Polyalthia longifolia*, *Eugenia operculata*, *Putranjiva Roxburghii*, Moulsari (*Mimusops elengi*), *Ficus retusa*, Neem (*Azadirachta indica*) and Pakur (*Ficus infectoria*). The function of the outer row is of shade only. These trees should be planted in pure avenues and not in mixed patches. Growth in pure avenues provides a beautiful skyline and a pleasing effect due to uniform size and shape of the crowns of the trees of the same species, while a mixture creates an ugly confusion with a jagged skyline. The inner rows should be planted with ornamental flowering trees only. The outer rows of shade trees will provide shade for pedestrians on the footpaths and at the same time will furnish a green background for the pink, red, crimson and yellow flowers of the flowering trees. The trees in both the rows should be planted at a distance of 30 feet from each other with the trees in opposite rows alternating.

Some Colour Schemes

While most of the flowering trees look beautiful when planted in pure avenues, there are some species which flower at the same time and the colour of their flowers also harmonizes

and hence appear more effective when planted together. Some of the flowering trees which flower in the same season are grouped below in schemes with due regard to colour harmony and are recommended for planting along our town roads.

SCHEME No. 1

Amaltas	*Gul Mohar*	*Amaltas*
(Yellow)	(Scarlet orange)	(Yellow)

This is a very striking colour scheme, the rich yellow colour of *Amaltas* flowers contrasting with the scarlet orange colour of Gulmohar blooms in the month of May when both the trees are flowering.

SCHEME No 2

Peltophorum ferrugin um Rusty Shield Bearer	*Colvi lea ra emosa* Colvilles Glory	*Peltopho um ferrugineum* Rusty Shield Bearer
(Golden Yellow)	(Orange red)	(Golden Yellow

This colour scheme is very effective in October when both these trees are flowering and a colour effect similar to that in scheme No. 1 is produced.

SCHEME No. 3

Jacaranda mimo a folia	*Grevillea robusta*	*Jaca anda m mosaefolia*
(Blue)	(Yellow)	(Blue)

Both these trees flower in April together and a beautiful colour-effect is produced, which appears soothing in the glare of April sunshine.

SCHEME No. 4

Spathodea nilotica Fountain tree	*Erythrina indica* Scarlet Erythrina	*Spathodea nilotica* Fountain tree
(Orange crimson)	(Scarlet red)	(Orange crimson)

Both these trees flower in March, when they are a blaze of colour.

SCHEME No. 5

Cassia nodosa	*Cassia marginata*	*Cassia nodosa*
(Pink)	(Pinkish red)	(Pink)

Both these trees flower in May and June when a very mellow colour scheme of pink and red colour is obtained.

SCHEME No 6
Bauhinia Scheme

Bauhinia variega. (Purple mauve Var.)	*B variegata* (White Var.)	*B. Krugii* (Light magenta)	*B. variegata* (Light pink Var.

This colour scheme which is composed of three varieties of *Bauhinia variegata*, pink, white and purple-mauve, and light magenta (*B. Krugi*) is recommended for dust-free roads of residential areas. All these Bauhinias blossom in a leafless condition from middle of February to middle of March when they look like huge bouqets of pink, white, purple and light magenta flowers. This is a very pleasing colour scheme and is highly recommended.

II

PLANTATION PLAN FOR OUR HIGHWAYS

A plantation plan for our National, Provincial and District Board highways is urgently wanted. In drawing such a plan, climate of a place, its temperature, rainfall, soil and water-level should be carefully considered and suitable species selected.

Avoid Mixtures

On account of indiscriminate planting and thoughtless replacements our roadside avenues have become very much mixed. Due to the difference in the shape of their crowns and rate of their growth they have a patchy appearance and from a distance present a jagged skyline. On the other hand if we plant pure avenues with one species only for a number of miles they will look harmonious and pleasing and the sky-line will be regular and wave-like. So it is very essential that mixtures of different species be avoided and we should have pure avenues of a single species for long stretches. This will not only improve their appearance but also render their management more economic, re-plantation easier and will rationalize their exploitation for commercial purposes. If mahuas and neems are grown in pure avenues for miles, oil-crushing industry can be easily started in such districts. Due to growth in compact areas there will be saving in transport charges. Similarly furniture-making industry can be encouraged in Sub-Himalayan districts which specialize in sheesham, sal and teak. Tamarind fruit which now only serves as a staple diet of monkeys, can be profitably exported to the Punjab, Sind and N.W.-Frontier Province.

List of Ornamental Trees Suitable for Town Roads

No.	Foliage trees for outer Avenue	Flowering trees for inner Avenue
1	*Averrhoa carambola* (*Kamrak*)	*Cassia fistula* (*amaltas*)
2	*Callistemon lanceolatum* (Bottle brush tree) ..	*Bauhinia purpurea*; *B. variegata*
3	*Anthocephalus cadamba*	*Colvillea racemosa*
4	*Eugenia operculata*	*Peltophorum ferrugineum* (Rusty shield bearer)
5	*Polyalthia longifolia* (*ashoka*) — ..	*Spathodea nilotica*
6	*Putranjiva roxburghii* (*jia pota*)	*Jacaranda mimosaefolia*
7	*Sterculia alata* (Australian bottle-necked tree) ..	*Poinciana regia* (*gul mohur*)
8	*Pithecobium saman* (Rain tree)	*Lagerstroemia flos-reginae* and *L. thorelii*
9	*Melia azadirach* (*neem*)	*Grevillea robusta*
10	*Tamarindus indica* (*imli*)	*Gliricidia maculata*

Mahua flower can be used for the manufacture of power alcohol.

SHADE

The main function of a road-side avenue is shade. Hence those trees which are quick-growing and provide dense shade should be selected. The trees selected should provide shade not only at sides, but also in the centre of the road. From this point of view trees with an umbrella or sub-umbrella crown like neem, mahua, imli and am, are more suitable than trees with a linear, elongated crown like teak, eucalyptus and millingtonia. If these trees provide shade, and also yield valuable timber or fruit, they are still more desirable. The trees should be planted 40 feet apart so that their crowns may develop freely. Where the road is more than 100 feet wide a double avenue of trees with the outer avenue near the boundary line, should be grown. A section of Lucknow-Rae-Bareli road has such a double avenue and the road is very shady and cool.

SELECTION OF TREES

Trees for various roads should be selected with due regard to rainfall, soil, temperature and water-level. Only those trees should be grown along roadsides which provide thick shade and are also valuable from the economic point of view. The following trees which are also shady and yield products of economic value, are recommended:—

(1) Neem (*Azadirachta indica*).—Its leaves and bark are used for medicinal purposes and its seed yields valuable oil. It can grow on alkaline Usar soil.

(2) Mahua (*Bassia latifolia*) fruit is edible and the seed yields an oil. It is also ornamental and its copper-red leaves appear beautiful in the months of March and April. Suitable for clayey soil and can also stand semi-alkaline soil.

(3) Imli (*Tamarindus indica*), a beautiful tree which stands the dust of roads very well, and its fruit and timber are also valuable. Suitable for dry areas.

(4) Sheesham (*Dalbergia sissoo*) yields excellent timber. Suitable for Sub-Himalayan districts with rainfall over 40".

(5) Mango (*Mangifera indica*) yields valuable fruit and dense shade. Suitable for clayey or mixed soil with water-level 30 feet or less.

(6) *Albizzia procera* (*Sufed siris*).—A quick-growing beautiful tree. Grows easily in sandy soils. On account of the light yellow colour of the trunk, it reflects even weak light. An excellent road-side tree.

(7) *Pitheclobium saman* (Rain Tree).—Suitable for moist districts, with rainfall over 40".

TREES UNSUITABLE FOR ROAD-SIDE AVENUES

The following trees should on no account be planted along the roadside:—

I. Brittle Trees—

(1) Eucalyptus (all species).
(2) *Millingtonia hortensis* (Neem chambeli).
(3) *Eugenia jambolana* (Jaman).
(4) *Albizzia lebbek* (Kala Siris).
(5) *Cassia siamea.*
(6) *Ficus glomerata* (Gular).

All these trees are fragile with very weak wood and consequently break easily in a wind-storm. The result is that after a heavy storm roads become blocked and traffic is stopped for a considerable length of time, and during a storm these trees are a positive menace to the lives of unfortunate travellers who happen to be on the road. Besides eucalyptus and neem chambeli have linear, elongated crowns which provide poor shade.

II. Thorny Trees—

(7) *Acacia arabica* (Babul).
(8) *Acacia modesta* (Phulahi).
(9) *Zizyphus jujuba* (Ber).

These are thorny trees and their thorns are a nuisance for pneumatic tyres of small cars, cycles and motor-cycles.

III

IDEAL VILLAGE PLANTATION

Village shamilat, the common land which is used for pasturing cattle, is ideal for village plantations. Old fallow land which has been out of cultivation for a long time can also be taken up for plantation purposes. The question is whether these plantations should be raised and managed by individual farmers or by the village panchayat. Plantation under the supervision of the panchayat and common ownership of the trees is an ideal solution, but the difficulty lies in the lack of corporate sense in many villages. Usually we find that everyone's responsibility is no one's responsibility, and trees planted with great effort are grazed by cattle. So we have to adopt both the remedies. In a village where a panchayat is functioning successfully the plantation should be raised by the panchayat, which can also appoint village youngmen as guards for protecting the trees in the first two years.

In the zamindari and taluqdari villages of Oudh, the waste-land belongs to the zamindar or the taluqdar and not to the cultivators. This is the biggest obstacle in the way of tree-plantation programmes in these villages. The tenants cannot be expected to plant trees for the benefit of zamindars and the zamindars are either too lazy to take up the plantation work themselves or the area of waste-land under their control is too vast and scattered to be planted by them successfully. To overcome this difficulty in the way of progress, the proprietary rights in the waste-lands must be given to the village panchayats.

INDIVIDUAL PLANTATION

In some villages it would be more feasible to partition the village waste-land into units 1 to 5 acres in area. These plots should be enclosed by kutcha-walls to give protection to young trees. Where water table is fairly high, a kutcha-well may also be dug in the plot. Near the boundary wall thorny fuel trees like babul or mesquite (*Prosopis juliflora*) may be planted. In the middle area fruit trees like desi mango and kathal may be planted. The fruit trees may occupy 25 per cent. of the area and the remaining should be covered by fuel and timber trees.

Note—The cost of printing this contribution has been defrayed by a generous grant from the Rockefeller Foundation for the publication of results of scientific work made to us through the kindness of the National Institute of Sciences, India.—*Ed.*

THE NUTRITION RESEARCH LABORATORIES, INDIAN RESEARCH FUND ASSOCIATION, COONOOR, SOUTH INDIA

By Dr. V. N. PATWARDHAN

THE Nutrition Research Laboratories, Coonoor, occupy a unique and honoured place among the scientific institutions in this country. This status has been achieved within a short period of a little over twenty years. It was in 1918 that Lt.-Col. R. McCarrison (as he then was) commenced work in Coonoor on Beribery Enquiry under the auspices of the Indian Research Fund Association. It had to stop in 1920 when McCarrison was invalided to England. Two years later when he returned to India, the Deficiency Diseases Enquiry was resumed with the generous support of the Indian Research Fund Association. But in a short time it was "axed" as a measure of retrenchment. There were thus two breaks in a short period. Undaunted, Col. McCarrison returned to the charge and in 1925, obtained further assistance from the Indian Research Fund Association. The enquiry this time bore the more comprehensive title of Nutrition Research; Col. McCarrison became its first Director. This attempt was destined to be more fruitful. The Pasteur Institute Association of Southern India had very kindly placed a part of the Pasteur Institute building at the disposal of the Indian Research Fund Association. The Government of Madras loaned the vacant buildings of an old jam factory for use as laboratories and animal house. It is in these two buildings that the Nutrition Research Laboratories have been housed right from the beginning. From a small beginning thus made over twenty years ago the Institution has gradually expanded and has reached its present state. To McCarrison, therefore, India owes a deep debt of gratitude for, it was his genius and foresight, coupled with an immense capacity for hard work, which rendered it possible for the Indian Research Fund Association to build up a first class scientific institution in India devoted to Nutrition Research. For nearly ten years since its inception it remained the only place in India where investigations in nutritional science were being carried out. It seems, however, that the work at the Nutrition Research Laboratories acted as a stimulus to other workers in this country for to-day we find a number of active centres of nutrition research all over India.

Major-Gen. Sir R. McCarrison, I.M.S., retired in 1935 and was succeeded by Dr. W. R. Aykroyd who was well known for his nutrition work on behalf of the Health Organisation of the League of Nations. Dr. Aykroyd guided the destinies of the Nutrition Research Laboratories for the next ten years at the end of which he resigned to take up the post of the Director of Nutrition in the Food and Agriculture Organisation of the U.N.O. in Washington. It is felt that no better tribute to these two men can be rendered than the putting on record an appreciation of their scientific work which has made the Nutrition Research Laboratories what they are to-day.

Almost every educated person in India today knows the differences in the physique and health conditions of the people in different parts of India. McCarrison was the first, however, to grasp the scientific significance of the fact. He proved by well-designed experiments that the relative nutritive values of various provincial dietaries was the cause of these differences. He was moreover convinced that at the root of ill-health and diseases in India lay the widespread malnutrition of the people. With the idea of scientifically investigating this aspect in connection with specific diseases that McCarrison undertook studies on goitre and urinary calculus.

From a study of the earlier published work and on the basis of his own observations on human beings and experimental animals McCarrison reached the following conclusions.

The thyroid gland grows more rapidly in early life of the individual than the body as a whole. Its weight, in relation to the total body weight, reaches a maximum at puberty in both sexes and declines thereafter. The gland is more susceptible to dietary influences during the phase of rapid growth. The enlargement of the thyroid under unfavourable conditions may be small and physiological or, on the other hand, may be abnormally great when the condition is called a goitre, the influencing factors being described as goitrogenic. The dietary goitrogenic influences which are the most important may exist either during (*a*) childhood, (*b*) adolescence and/or (*c*) throughout the whole span of life. "In the last event the stigmata of goitre—*i.e.*, congenital goitre, cretinism, deafmutism and varying grades of physical and psychic degeneration—appear in the new-born of the species" (McCarrison). Among the goitrogenic influences were (1) excess of fats, fatty acids and lime, (2) deficiencies of vitamins A, C, iodine, etc., and (3) goitrogenic substances present in foodstuffs, such as cabbage, groundnuts, maize, etc. The occurrence or otherwise of goitre depended upon the interplay of these three factors.

The work on goitre has been published in an *Indian Medical Research Memoir*, No. 23, March 1932, entitled "The Life-line of the Thyroid Gland: A Contribution to the Study of Goitre".

McCarrison's work on Urinay Calculi was equally productive of interesting results. It was concluded from hospital statistics collected for the years 1926-28, that in India the incidence of urinary calculus was 1 per 10,000 although it was not uniform throughout India. The "stone area" covers what is known as the wheat

belt, i.e., Sind, North-West Frontier Province, Punjab, and western parts of the United Provinces. In Bombay, Madras, Hyderabad and Mysore, the disease was rarely encountered. There was one interesting observation in this connection and it was that in Manipur in Assam, in the midst of the rice-eating population, the incidence of the stone was again found to be high.

The role of diet in the production of stone was experimentally investigated in the laboratory rat. The stones produced in the urinary tract of the rat on different diets were removed and analysed. These stones were found to be either phosphate stones or calcium stones. In the former case they consisted of magnesium ammonium phosphate and in the latter of calcium carbonate or calcium hydroxide or both. The human stones (removed at operation) were found to consist of a mixture of uric acid or urates, calcium oxalate, calcium phosphate and sometimes magnesium ammonium phosphate. The absence of uric acid or urates in stones in the rat was due to the uricolytic metabolic activity in the rat, which, however, is absent in human beings.

The composition of urinary calculi in cattle was found to be similar to the calcium carbonate stone produced in the rat. The deficiency of vitamin A and imbalance between calcium and phosphorus was shown to be effective in producing stone in rats. The same influences were responsible for stone-formation in cattle. It is true that the mechanism of stone-formation is not fully known even now, but the experiments of McCarrison showed beyond doubt the part played by faulty diets. Further work on this problem is obviously needed.

Although the two main investigations occupied much of McCarrison's attention his wide interest led him to explore other fields such as (*a*) the effect of dietary deficiency on the histopathology of the gastro-intestinal tract, (*b*) relation of rice to beriberi in India, (*c*) Lathyrism, (*d*) nutritive value of Indian foodstuffs, etc.

Dr. Aykroyd's interests lay in the field of applied nutrition. Immediately on assuming charge he commenced systematic study of the dietary habits of population groups and their relation with the prevalence of diseases which could be traced to malnutrition. His pioneer work on nutrition surveys in India was soon followed up by workers in other parts of India, so that by 1940 sufficient material existed to provide a fairly comprehensive although far from complete picture of ndian dietary habits. The information was compiled and published by Aykroyd as a *Note on the Results of Diet Surveys in India.*

In the meantime the Indian foodstuffs were being subjected to analyses in the Laboratories and in 1938 appeared a booklet, popularly known as *Health Bulletin*, No. 23. It contained valuable information on the nutritive value of hundreds of common and uncommon Indian foodstuffs. The researches on (*a*) the pathogenesis of experimentally produced deficiency diseases, (*b*) the physiological function of vitamins, (*c*) insect nutrition and (*d*) clinical research in diseases of chronic malnutrition were also pursued with great vigour by Aykroyd and his associates leading to some interesting results.

A Nutrition Clinic, started at the Stanley Hospital, Madras, with the co-operation of the Surgeon-General with the Government of Madras and the Hospital authorities, has proved a great success. The work done there during the last four years has brought to light important facts concerning chronic diarrhœas of nutritional origin, the etiology of phrynoderma, skin manifestations of vitamin deficiencies and the burning feet syndrome.

Phrynoderma or follicular hyperkeratosis has come to be accepted as being due to vitamin A deficiency. Aykroyd doubted this, however, and recent studies at the Nutrition Clinic have brought to light what might be called reliable evidence to show that phrynoderma is associated not with vitamin A deficiency but with the deficiency of one or more members of vitamin B_2 complex and unsaturated fatty acids.

Burning feet syndrome is a peculiar clinical condition. It had been observed to occur among the poorer population groups in the Nilgiris nearly ten years ago. It actually came into prominence, however, when reports were published at the end of World War II from prisoner-of-war camps in the Far East. In these cases, yeast, yeast extracts or foodstuffs containing vitamin B proved to be effective. Recently at the Nutrition Clinic, Stanley Hospital, several cases of this type were investigated and the therapeutic trials brought out the fact that pantothenic acid had a marked curative effect. Burning feet syndrome thus appears to be a condition due to a deficiency of one of the minor members of the B complex.

During the war years Aykroyd was called upon to advise Provincial and Central Governments and the Indian Army on matters connected with nutrition. He was a member of the Famine Enquiry Commission which was appointed after the Bengal Famine disaster to go into the whole question of (*a*) causes of famines and means of preventing their recurrence, (*b*) possibility of improving the diet of the people and quality and yield of food crops and (*c*) improvements in the food administrative machinery. Aykroyd's wide knowledge of nutrition conditions in India and abroad and his earlier work with the League of Nations must have stood him in good stead in this last of his important tasks in India.

The war did not spare the Nutrition Research Laboratories. On account of its unique position, the advisory work at the Laboratories increased enormously encroaching upon the normal research activities. In other ways too the Nutrition Research Laboratories suffered a great deal. Some members of the staff joined the army, others left for more attractive posts. At that time it was found difficult to fill the vacancies. Further, the supplies of chemicals and apparatus could not be obtained during war years. It is a wonder that in spite of all these difficulties the Laboratories did maintain the output of scientific work not far below the peace-time level.

Neither McCarrison nor Aykroyd singly could have achieved so much without the assistance of a band of enthusiastic workers. They had with them clever, intelligent and hard-working young scientists some of whom are to-day occupying important positions in the scientific world of India. It is invidious to make distinctions by naming one or more individuals for all have given their best. It will be in the fairness of things to state here that their love of science, initiative and loyalty to the institution and to their chiefs have contributed in no small measure to the success of the Laboratories.

Now the Nutrition Research Laboratories are entering a new phase in the post-war India. Till recently the organisation has been functioning as one of the many scattered institutions devoted to the task of preventive medicine considered in its broadest aspect. In future its fate is likely to be linked with the growth of a Central Medical Research Organisation as has been conceived by the Health Surveys and Development Committee of the Government of India. It is inevitable that there should be a great expansion in the scope and activities of the Nutrition Research Laboratories both in the realm of basic and applied researches on Nutrition. When that takes place it will be such that the needs of science and the community are equally well served.

Note – The cost of printing this contribution has been defrayed by a generous grant from the Rockefeller Foundation for the publication of results of scientific work made to us through the kindness of the National Institute of Sciences, India.—*Ed.*

INDIAN ASSOCIATION FOR THE STUDY OF HISTORY OF MEDICINE

At a meeting of the members of the staff of the Madras Medical and the Stanley Medical Colleges, held on the 5th February 1947, the above Association was inaugurated. Major-General Huban who presided over the meeting referred to the history of medicine as a fascinating one which was being studied in America by many Institutions and Societies. Dr. Kutumbiah, Principal, Stanley Medical College, explained the objects of the Association and suggested that the Association could stimulate interest in the subject by organising exhibitions of medical manuscripts, old printed books, paintings and objects pertaining to the History of Medicine.

To promote study of and investigations in medical history, they would collect books dealing with history of medicine of various countries as well as the classics in medicine and place the library at the disposal of scholars interested in special subjects. They expect also to collect some manuscripts and get the co-operation of Sanskrit scholars and Arabic scholars in the study of rare manuscripts and printed works in these languages. Archæologists and anthropologists as well as historians will also be requested to co-operate with them, in the study of the various aspects of medicine. It was also intended to run a Journal on behalf of the Association. Proceedings of the meetings, papers and discussions of original articles, critical studies, reviews of books and lists of publications on history of medicine will in this manner reach the wider public in India and the learned Societies abroad. He hoped that the Society will be able to secure good support from the medical profession and the cultured public in India. He was confident that, with the support of the distinguished members of the profession present on the occasion and of those who have promised hearty co-operation, the Association will soon be able to give a good account of its work and stimulate great interest in the study of history of medicine and make valuable contributions to medical history. He was anxious that the Society should establish contacts with similar Associations, Societies and Clubs devoted to the study of History of Medicine in Europe and America.

Dr. P. Kutumbiah (Stanley Medical College) and Dr. D. V. S. Reddy (Medical College) were respectively elected President and Secretary of the Association.

SUMMARIES OF ADDRESSES OF PRESIDENTS OF SECTIONS INDIAN SCIENCE CONGRESS, DELHI, 1947

POSSIBLE APPLICATIONS OF THE FUNCTIONAL CALCULUS*

STARTING with a single valued function $f(x)$ defined in the closed interval (0, 1), the President outlines the construction of a vector-space of an enumerable infinity of dimensions. Introducing a general concept of integration over a permissible class of sets, the President dealt with the construction of sets of normal orthogonal functions $\phi_1, \phi_2, \ldots \phi_r, \ldots$ and the expansion of a suitable function f as a linear combination $\Sigma a_r \phi_r$. The concept of distance in the function space is introduced in the form $D^2(f, g) =$

$$\int\int K(x, y)\,[f(x) - g(x)]\,[f(y) - g(y)],$$

where $K(x, y)$ is a kernel which may be symmetric or non-symmetric. Writing this right side as $\int (f-g) \times (f-g)$, where the operator Xf is defined as $\int K(x, y)\, f(y)$, integration being with respect to y, a few properties of this operator are set forth.

Some applications of these ideas to statistics, harmonic analysis, etc., are hinted, but we must wait to study in detail when the author publishes his theory in full, and works out the intended applications on a comprehensive scale.

The Indian Science Congress Session and its Proceedings have begun to attract scientists the world over, and it is not in the fitness of things that such Presidential Addresses are printed and got up in such a poor way as to make it an ordeal to read through it. The proofs were not corrected by the author, and a number of errors, printing and otherwise, have crept in.

C. N. S.

* Summary of Presidential Address delivered by Prof. D. D Kosambi, to the Section of Mathematics, 34th Indian Science Congress, Delhi, 1947.

DESIGN OF EXPERIMENTS*

"STATISTICS is a young science ... and its potentialities for the advancement of human knowledge and welfare are as yet largely unrealised and unexplored", said Mr. R. C. Bose in his Presidential Address to the Statistics Section. The address is a comprehensive survey of the subject "The Design of Experiments" as it stands to-day with all its theoretical developments, practical applications and unsolved problems necessitating the active interest and patient researches of mathematicians. At the very outset the important problems of theoretical statistics, viz., heterogeneity of the material, graduation of data, sampling from populations, distribution and estimation of parameters, and testing of hypothesis are vividly explained and work done so far in these fields are briefly indicated. After defining his subject *design* as "The problem of determining 'Optimum' allocation of the experimenter's resources in the collection of the observations", he explains the problem (of design) clearly and shows that the treatment effects to be studied or compared are only linear functions and so are problems in linear estimation; there follows a brief account of the theory of linear estimation from the point of view developed by himself and its connection with the analysis of variance and the well-known Student's t- and Fisher's z-distributions. Based on these ideas the general theory of the analysis of experimental design is developed. Further we have a complete review of the work done so far in the field of balanced incomplete block designs which have been developed in order to overcome "insensitiveness" and to meet economic considerations. Reference is also made to partially balanced incomplete block designs, Latin square, complete and partial Youden square designs. A short peep into the region of factorial designs and confounding forms the finishing touch to this brief picture. In conclusion, a moving appeal is made for establishing a "fruitful co-operation between the experimenter and the applied worker on one hand and the theoretical and mathematical statistician on the other".

M. C. SATYANARAYANA.

* Summary of Prof. R. C. Bose's Presidential Address to the Section of Statistics, Indian Science Congress, Delhi, 1947.

DISORDER IN ATOMIC ARCHITECTURE*

IN his Presidential Address, Prof. Banerjee dealt with the results of X-ray investigations of atomic derangements in crystals which have not been completely understood as yet. After giving a brief review of the experimental work carried out up to the present on the extra reflections in X-ray photographs as well as of the various theories proposed to explain them, the author describes the results obtained by him with crystals of phloroglucine dihydrate and benzil.

In the case of phloroglucine dihydrate the extra reflections are extremely sharp. The central parts of the spots are blank indicating thereby that the central part of the crystals do not show the effect, although the X-ray reflecting power is uniform throughout the entire portion of the specimen. The spots corresponding to $h = 0$ or $k = 0$ are absent. The observed features of the extra reflections in phloroglucine dihydrate cannot be explained satisfactorily on the basis of either the thermal theory or the theory of crystal defect. Prof. Banerjee gives a satisfactory explanation of the observed phenomena on the basis of the modified Raman theory. The extra reflections arise from the excitation of infra-red oscillations by the incident X-rays. The sharpness of the spots in this particular case indicates that the phase waves travel along the c-axis, while along directions normal to the c-axis the atoms should all vibrate in identical phases. This can happen only if one postulates that the

* Summary of Prof. K. Banerjee's Presidential Address to the Section of Physics, Indian Science Congress, Delhi, 1947.

infra-red oscillations excited by the incident X-rays induce same elastic waves travelling along the c-axis. The absence of the expected spots lying on the axial lines in the Laue photographs taken with the X-ray beam along the c-axis can also be satisfactorily explained by the modifications of the Raman theory suggested above.

In the Laue photographs of benzil taken with monochromatic X-ray beam along the trigonal axis of the crystal continuous lines appear where the layer lines would appear if the crystal were rotated about its three-fold symmetry axes. Similar continuous lines have also been observed in Laue photographs with the X-ray beam along the [1010] and [1120] directions. These results are suggestive of the existence of derangement waves lying along the planes normal to [10$\bar{1}$0] directions as well as along the basal plane though not so densely. The extreme sharpness of these lines indicates that the derangement waves lie strictly along these planes or have extensions in two dimensions. The continuous lines may, therefore, be considered as extra reflections due to two-dimensional derangement waves. Another feature observed in the case of benzil is the absence of the continuous lines corresponding to the zero layer lines. These facts are explained by Prof. Banerjee on the basis of the Raman theory with the same modification, *viz.*, that the lattice oscillations that are generated inside the crystal due to absorption of X-rays generate elastic waves and the phases of the oscillations over different regions of the crystal are regulated by these elastic waves. It is necessary to suppose that in a crystal such an oscillation may be set up along certain discrete directions, and that elastic waves may be propagated along certain restricted directions.

SOME ASPECTS OF DHARWAR GEOLOGY WITH SPECIAL REFERENCE TO MYSORE STATE*

IN this address Prof. C. S. Pichamuthu has attempted to give a picture of the conditions which probably existed during the Dharwar Period. The Dharwars occur at the present time in isolated strips, remnants of a formation which must once have covered a large portion of Peninsular India. They exhibit variations in stratigraphic succession, dislocations on a gigantic scale, and differences in metamorphic grade, and so the problems presented by them are very complicated and difficult. A most intriguing question that arises whenever we deal with this ancient formation is, whether the Dharwar are the oldest, or whether they were laid down on some pre-Dharwar rock. Prof. Pichamuthu does not consider the Lower Dharwars as the earliest formed rocks. The existence of current bedded quartzites in the Lower Dharwars, and the pebbles of gneiss in the conglomerates of the Middle Dharwars indicate, according to him, the existence of a Pre-Dharwar gneiss which formed the Dharwar basement.

He next traces the history of the development of the idea of the sedimentary origin of the constituents of the Dharwar Schists of Mysore, and suggests that in the Dharwars of Mysore, two distinct sedimentary cycles can be recognised. Each orogenic revolution is accompanied or followed by abyssal injection and volcanic action, and the Dharwars of Mysore illustrate this feature very well, for at the close of each sedimentary cycle there are instances of vulcanism. Leaving aside the probability of a Pre-Dharwar granitic intrusion, Prof. Pichamuthu is of the opinion that there were three separate granitic eruptive epochs, one at the closing stages of the Middle Dharwars, the other at the end of the Upper Dharwar period, and a third which was a very much later one, comprising the Closepet granite and similar pink porphyritic granites.

The Dharwar period covers several million years and so variations in climate are to be expected. There are evidences of both warm climate and an intensely cold spell.

In referring to the life during the Dharwar Period, mention is made of the occurrence of blue green algæ in some cherts.

The discovery of current bedding and graded bedding in the Dharwars of Mysore has opened out new possibilities of working out the complicated tectonics of these rocks.

The topography of Mysore is dependent on the geology of the State and the Dharwar rocks have had a great influence in developing the major landscape features. The ferruginous quartzite which is one of the constituent rocks of the Dharwars is very resistant to weathering, and this explains why the Dharwar Schist region which occupies only one-sixth of the area of the State contains many of the biggest hill ranges in contrast to the Peninsular gneiss region which has reached the stage of peneplanation with only occasional monadnocks. The trend of the Dharwar Schists has also greatly influenced the drainage pattern of Mysore State.

Adequate stress has not so far been laid in Mysore on the stratigraphical and structural aspects of the Dharwars. Textural and structural features such as current bedding, ripple marks, graded bedding. intraformational folds and drag folds will doubtless shed light on stubborn tectonic problems, and help in the correlation of rocks composing the widely scattered outcrops belonging to the Dharwar System. Petrofabric analysis is a technique which is bound to be very useful in this study.

The question of the ages of the different igneous intrusions in the Dharwar period is another important problem which has not as yet been investigated. Radioactivity data and principles afford a mode of attack. Heavy mineral analysis is also a valuable aid for correlating rocks of the same period of intrusion, and for separating suites of rocks of different ages.

The address concludes with the note that while a great deal of work has been done on the Dharwars, much remains yet to be accomplished, for problems which appeared to be

* Summary of Dr. C. S. Pichamuthu's Presidential Address to the Section of Geology and Geography, Indian Science Congress, Delhi, 1947.

relatively simple, gather greater complexity as knowledge progresses.

MORPHOLOGY OF THE GYNÆCIUM*

ADDRESSING the Section of Botany, Professor Joshi has covered the welter of controversy in which the morphology of the gynæcium is shrouded. The approach to the problem has lain along varied paths and the number of theories is legion. It is significant that among these, the concept of the Poet-Philosopher Goethe has weathered the storm of controversy and stands to-day with the widest measure of support. Known to botanists as the "Classical Theory" Goethe's doctrine would have the leaf as a morphological constant from which all the other appendages of the stem have arisen. The carpel is equivalent to a leaf folded upwards along its mid-rib and bearing ovules on its incurved margins which unite to form the ventral suture. Evidence for this has come from carpels of several plants and Professor Joshi's observations lead him to believe that the fusion of the carpellary margins can be noticed in the early stages in nearly all carpels, while in Boerhaavia, it persists to the fruiting stage. Thomas' suggestion that one should look for the progenitors of the modern carpel in the reproductive organs of the Caytoniales, and the theory of Carpel Polymorphism have both come in for withering criticism. The inferior ovary is now believed to be of an appendicular nature having arisen by a concrescence of the basal portions of the calyx, corolla, stamens, and the ovary and Professor Joshi working on the Amaryllidæ has made notable contributions in this field. In a reference to the different form of ovules in the Angiosperms, Professor Joshi visualises that mechanical pressures exerted during development along with mutations have together determined the varied types.

K. V. SRINATH.

* Summary of Prof. A. C. Joshi's Presidential Address, to the Section of Botany, Indian Science Congress, Delhi, 1947.

SOME PROBLEMS OF INDIAN ANTHROPOLOGY*

"ONE conviction", says Dr. Karve, "which is forced on every worker in India is that nothing whatsoever is lost either physically or culturally in the peculiar way in which Indian culture is shaped. The primitive lives check by jowl with the latest and the most sophisticated. The unbounded tolerance for other customs, other dresses, other faces and other gods, has resulted in a culture which adds to its repertory of cultural and physical features and never destroys anything deliberately. The process of elimination of the old and the adoption of the new goes on very slowly and never hits the whole population simultaneously. We have the curious phenomenon of castes and tribes following their age-long customs in the midst of the modern world, not because they have no knowledge of the new, but because they think that their way of life is as good as any other. They represent, thus, petrified history and give clues about the time and origin of their migration as about their physical affinities. As social reformers, too eager to impose our standards of life and morals on unlettered communities, we may deplore this vast and varied panorama of social life, but as ethnologists and anthropologists we must make the most of this unique opportunity to record all customs, speech, songs and physical types. An accurate record of this type will help to unravel human history. It will also help a nation which is eager to govern itself, by giving an idea of the mechanism of cultural transformations, about the relativity of moral ideas, about the whole social process it may wish to influence or change."

With very few exceptions, Indian ethnic history has been one of receiving peoples; India has not been a corridor of migration but a blind alley. The main routes of folk and culture migrations were well defined even during the Puranic and historic times. The middle Indian highlands are not so much to be regarded as culture barriers, but as regions of culture contact between the northern and southern cultural areas. Along with several common elements of culture, these two regions have significant differences, particularly in the matter of kinship usages. Light is thrown on the problems of culture contact by the study of migrations and movements of the various beginning with the Brahmins. This leads on to the crucial question whether and how far the bearer of the different caste names are ethnically different as most of them seem to be. The answer to this big question demands more of intensive work both in physical and social anthropology. As a result of the regional surveys of blood groups made so far it has been found, broadly speaking, that there are regions and communities where groups O, A and B are concentrated. A thorough survey of the castes and sub-castes in the Gangetic region "may lead to the pinning down of the B blood group to its proper racial element and to its proper region." The Indian caste system, which is an unmitigated evil socially, provides opportunities for intense research to anthropologists and geneticists. Each caste claims blood relationship of all its members and in the case of the smaller castes the blood tie is no doubt true. The feeling of belonging together is sometimes the result of a caste profession or of common traditions. Different castes may have originated from a common stock or they may have sprung from different stocks altogether. Genetical investigations will, therefore, have to be checked and verified in the light of cultural and historical background. Hence the need for anthropologists taking up this line of investigation. The vast and urgent task awaiting the anthropologists in this country require far greater resources both in men and money.

A. AIYAPPAN.

* Summary of Mrs. I. Karve's Presidential Address to the Section of Anthropology and Archæology, Indian Science Congress, Delhi, 1947.

PSYCHOLOGY AND THE REHABILITATION OF HUMAN SOCIETY*

PROFESSOR NAIDU'S address begins with the observation that the present is the most critical period in the history of human race and compared with the magnitude of the disaster which is threatening the world to-day, the crises in the past history of man pale into insignificance. He is of the view that the phenomenon of war as such is not disquieting, but the regularity and the frequency with which humanity is seized with it, that is really most disquieting. The advance of civilization has helped only to retain the methods by which nations seek the blood of brother nations. At the slightest pretext one nation flings itself at the throat of the other in a fratricidal war; and we are led to ask the question, "What is the remedy?"—if there is any remedy at all for all these ills. The answer is, "There is hope for man yet; and that hope comes from psychology."

The professor is of the view that in days gone by people had intuitive or mystical knowledge and that was enough to keep man free from mischief; but science, which came later, in fullness of time, destroyed spirituality and mysticism and failed to put anything in their stead. To quote the professor, "The rudder has been broken, the ballast thrown overboard, while the winds on the sails are being blown into ferocious violence. The vessel is heading towards the rock and something must be done and done at once to save man from disaster."

There is an encouraging sign, however, and that is, scientists are steadily realising the need for a reorientation of the values of science. The tendency on their part to speak of the social functions of science and to assess scientific achievement in terms of human values is growing steadily. It is being realised both by scientists and political thinkers alike that there is a lag between the achievements of man's brain and the deeper promptings of his heart. There is, no doubt, a feeling among scientists that by reshuffling the environment, human nature may, somehow, be improved; but it is not realised that without understanding the psychological forces, governing human behaviour, it will be impossible to plan for the improvement of human society. It is, therefore, recommended that in all plans for the future ordering of human society, the findings of applied, experimental and depth sections of psychology should be accorded the place of prime importance. That is, the science of man should be accorded the place that is due to it.

It is stated that the science of psychology prescribes the three grades of Efficiency, Happiness and Self-realisation as worthy of pursuit by man. "Efficiency relates to the body and the spiritual levels of mind, happiness to the deeper mental levels, and self-realisation to the total personality and to the whole being of man." In general, psychology suggests the methods by which human society can be rehabilitated. Applied and experimental psychology will help man to attain efficiency, depth psychology, the attainment of happiness and the spiritual psychology, the realisation of the highest goal of self-realisation.

A plan is then suggested for achieving the efficiency in our National life. An extensive nation-wide survey of the abilities of the boys and girls of all ages and grades, who are now at school, should be undertaken. Along with the medical inspection of children, the listing of intelligence also must be carried out. In the medical inspection charts the results of mental test should be recorded. To prepare the test-material in the various Indian languages, there should be a central Psychological Research Organisation set up. For discovering the innate capacities of children of school-going age tests of special ability should be prepared and applied. By annual re-testing an anxious watch should be kept on the way his ability unfolds itself. In the High School or Polytechnic stage, steps should be taken to train and develop the latent capacity according to strict psychological methods. The data gathered from the psychological tests of intelligence, abilities and temperaments should be subjected to the most up-to-date statistical treatment and the profile drawn for the individual. Job profiles, also, should be carefully prepared. Then remains the task to fit the individual to the job best suited to him. This will account for the attainment of the goal of efficiency. There is, then, need for bringing into being an Indian Institute of Industrial and Applied Psychology. This body will frame and standardise tests and will be charged with the task of organising a Psychological Survey of India. In fact, it will conduct field work on human engineering. Finally, a National Council of Psychology should be entrusted with the task of eliminating avoidable wastage, pain and misery in human society.

Sentiment-building is the process by which culture—individual or racial—comes into existence, and it is here that we must look for happiness. By a process of reasoning, the professor concludes, that no one can hope to plan for happiness by reshuffling the economic structure of society, if he does not have a firm grasp of the psychological forces, which control the economic life of man. He pleads for a psychological orientation of all plans for economic and industrial reorganisation for the reform of society and for educational re-orientation and above all for banishing war. To achieve this it is suggested that a National Psycho-Analytic-Psychiatric Service should be brought into being. Extension Lectures and training in depth psychology should be organised. In fact, the utility of preventive psychotherapy in the daily life of the civilised citizen should be realised.

Finally, for the attainment of self-realisation, which is the final goal of human life, the steps to be followed are also suggested. They are faith in divinity, then the company of holy men and then concentration, meditation and prayer, then taste for spiritual enjoyment, then attachment for the Lord followed by divine love, the final realisation.

Thus the address was a passionate plea for the study of psychology and application of its results and methods as a remedy for the various ills man is subjected to in the present day and for the proper rehabilitation of human society on sound lines.

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* Summary of Prof. P. S. Naidu's Presidential Address to the Section of Psychology and Educational Science, Indian Science Congress, Delhi, 1947.

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A FUNDAMENTAL RESULT FOR ROTATING RECTANGULAR CARTESIAN FRAMES

IN the following is reported a result for a rectangular cartesian frame rotating uniformly with respect to another having the same origin. Although it is simple and interesting it is far from obvious and does not seem to have attracted any attention so far.

Let O-xyz be a frame with respect to which $\dot{x},\dot{y},\dot{z}$ are the velocities and $\ddot{x},\ddot{y},\ddot{z}$, the accelerations of a particle at time t. Let O-XYZ be another frame with respect to which $\dot{X},\dot{Y},\dot{Z}$, $\ddot{X},\ddot{Y},\ddot{Z}$ can be similarly defined. At the instant when the three pairs of axes Ox, OX, Oy, OY and Oz, OZ coincide let one set rotate about the other with constant angular velocity (p, q, r). It can then be verified that

$$(\ddot{x}-\ddot{X})(\dot{x}+\dot{X})+(\ddot{y}-\ddot{Y})(\dot{y}+\dot{Y})+(\ddot{z}-\ddot{Z})(\dot{z}+\dot{Z})=0$$

This implies that *the vector representing the relative acceleration is perpendicular to the vector representing the mean of the velocities.* The verification is made immediate when, for example, one puts

$$X = \dot{x} + qz - ry,$$

$$\ddot{X}=\ddot{x}+2q\dot{z}-2r\dot{y}+pqy+prz-x(q^2+r^2)$$

etc.

The above property came to my notice while Prof. V. V. Narlikar and I were investigating a relativistic problem of rotation.

KAMALA PRASAD SINGH.

The Department of Mathematics,
Benares Hindu University,
January 1, 1947.

ULTRA-VIOLET BANDS OF THE MERCURY IODIDE MOLECULE

THE two band systems of the mercury iodide molecule in the region λ 2240-λ 2100, reported by Prilheshejewa[1] and designated by us as the G and H systems,[2] have been newly measured. They consist of about 50 and 25 band heads, definitely degraded to the red. A complete vibrational analysis of the two systems has given the following constants:

	G system	H system
ν_e =	45542·4	47110·2
ω'_e =	88·0	97·1
$\chi'_e\omega'_e$ =	0·2	1·65
ω_e'' =	125·7	125·3
$\chi_e''\omega_e''$ =	1·2	1·15

The two systems have a common final level which is known to be the ground state of the molecule. The H system presents an interesting case of predissociation similar to that observed in the β system of NO or the Fourth Positive system of N_2. It consists of just just three v'' progressions of bands with $v' = 0, 1$ and 2, and the bands show an abrupt termination, those with higher values of v' being absent altogether.

A full report of the work will be published shortly.

Andhra University, K. R. RAO.
Waltair, C. RAMA SASTRY.
January 9, 1947.

1. Prilheshejewa, *Phys. Z. Sowjet.* 1939, **1**, 189.
2. Rao, K. R. and others, *Ind. Jour. Phys.*, 1944 **18**, 323.

TEMPERATURE AND PRESSURE VARIATION OF HEAT CONDUCTIVITY OF LIQUIDS ON OSIDA'S THEORY

ARGUING from a model of liquid structure similar to that proposed by Andrade[1] in his theory of viscosity of liquids, Osida[2] deduced,

$$K = 4k\nu/\sigma \qquad (i)$$

in which K is the coefficient of heat conductivity of the liquid, k the molecular gas constant, ν the vibration frequency of the liquid molecules, and σ the mean inter-molecular distance.

Temperature increases σ. From Einstein's well-known expression[3] for ν, viz.,

$$\nu = C \times 0{\cdot}77 \times 10^{12}\sqrt{T_m/MV^{2/3}} \qquad (ii)$$

where C is a constant, T_m the melting-point on the absolute scale, M the molecular weight, and V the molecular volume $N\sigma^3$, it follows that

$$\nu \propto 1/\sigma\ ;$$

that is, an increase in σ (as a result of temperature rise) is accompanied by decrease of ν. Such a conclusion was arrived at by Macleod[4] from considerations of free space in liquids. A negative temperature coefficient for K is therefore to be anticipated. This result, obtained from theory, is in agreement with the findings of Bridgman[5] in the case of all liquids, except water, which has a positive temperature coefficient. The behaviour of liquid metals also falls in line with the above deduction.[6]

Bridgman[5] has shown that K increases with pressure, the effect being greater for more compressible liquids, and at 75° than at 30° C. Further, the temperature coefficient of all liquids at pressures above 3,000 kg./cm.^{2} is positive. The effect of pressure is to reduce σ causing thereby an increase in ν. The increased conductivity of liquids under pressure is thus explained with more compressible liquids, and at high temperatures, the reduction in σ due to a certain pressure will be more marked than with less compressible liquids and at low temperatures.

The high conductivity of water is due to its associated nature. In associated liquids, apart from the propagation of heat by collisions as postulated by Osida,[1] an addtional factor is the following: When an associated complex arrives at the hotter part of the liquid as a consequence of irregular heat movements, it partially dissociates into smaller units; conversely, when these smaller units come into the colder parts they partially reunite. Since dissociation is accompanied by heat absorption and reformation of complexes by generation of heat, this process would enhance the thermal conductivity. An additional factor is the greater vibration frequency of the smaller units formed in the process. Due to the formation of such smaller units with greater ν at higher temperatures, water has a positive temperature coefficient of conductivity. The positive coefficient of all other liquids, above 3,000 kg./cm.^{2}, investigated by Bridgman[5] might be due to the formation of complexes at such high pressures.

My thanks are due to Prof. S. S. Joshi, D.SC. (London), F.N.I., for his kind interest and encouragement.

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January 27, 1947.

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THE VISUAL SHAPE OF THE OVERCAST SKY

THE problem of the apparent shape of the cloudy sky is one of much interest in meteorological optics. This was partially investigated by Miller and Neuberger[1] in the case of skies covered with 90 per cent. or more of clouds based below 10,000 feet. Their results lead to the surprising conclusion that the half-arc angle[2] decreases with increasing cloud-height; in other words, the sky appears to become flatter with increasing cloud-height. No explanation has so far been suggested for this anomaly. It was felt desirable to examine whether this conclusion holds for overcast skies, whose ceiling lies above 10,000 feet. In view of the uncertain influence on the half-arc angle of differential illumination of the clouds when they are cumuliform,[3] measurements were made by the author only when the skies were totally overcast with the *stratiform* type of medium and high clouds based above 10,000 ft. In this note are reported the results of those measurements. An attempt has also been made to offer a possible explanation for the observed anomaly.

The method of determination of the half-arc angle is the same as described in a previous communication.[4] In order to obviate the effect of partial illumination and differing visibility on the half-arc angle, all measurements were made at about noon-time when the sun was near the zenith and under conditions of good and nearly identical visibility of 20-25 miles. Eight measurements were made at a time in four different directions free from orographic elevations and their mean was adopted as the representative value.

The results reproduced in Table I are the means of a number of representative values for skies overcast with stratified clouds of

TABLE I

Kind of cloud	Average height of base in ft.	Half-arc angle in deg.	Ratio OII/OZ
Thick Altostratus	10 000	27·1	2·73
Thin Altostratus	13,000	26·6	2·80
Thick Cirro stratus	17,000	26·2	2·85
Thin Cirro stratus	22,000	25·4	2·97

approximately the same height of base. In the fourth column of this table are given the ratios of the apparent distances of the horizon and the zenith from the place of observation (CH/OZ), calculated on the assumption of a circular profile for the meridional section of the sky.

The half-arc angles reported by Miller and Neuberger for cloudy skies with average base at 1,200, 3,900 and 8,900 feet respectively are 29°·2, 28°·0 and 27°·2. These values fit in very well with those in the above table, which show a steady diminution with increasing cloud-height. The observed inverse relationship between the half-arc angle and the cloud-height cannot be explained on a geometrical basis, on which, there should indeed be a positive correlation between the two.

The true explanation for the observed anomaly appears to consist in the subjective perception of depth, which varies according to the kind and colour of the cloud. As the author has recently pointed out while discussing the apparent enlargement of the sun and the moon near the horizon,[5] a darker object tends to impress the eye as being more distant and bigger than a brighter one at the same distance, all other conditions remaining equal. The thicker and darker the cloud, the more convex would the overcast sky therefore appear. Amongst the cloudy skies referred to in the above table, the maximum convexity would seem to be associated with the thick and greyish altostratus cloud, which is practically impervious to direct sunlight; and the minimum convexity with the high and whitish cirro-stratus cloud, through which the sunlight easily penetrates. In the case of low clouds, the thicker and darker the ceiling, the higher does it look.

One fact of practical interest that emerges from this investigation is that subjective impression considerably influences the visual estimation of the heights of base of clouds. There is a general tendency to under-estimate the heights of medium and high clouds. This tendency is more pronounced, the brighter and thinner the clouds are. The heights of low clouds are overestimated and this the more so, the thicker they appear. It may, therefore, be laid down as a safe rule to follow in utilising data of estimated cloud-heights in meteorological work, that the actual heights are higher in the case of medium and high clouds and lower in the case of low clouds than the estimated ones.

In conclusion, the author wishes to express his grateful thanks to Mr. B. N. Sreenivasaiah, Regional Director, Regional Meteorological Centre, Madras, for his kind encouragement during the course of this work.

Meteorological Office,
St. Thomas' Mount,
Madras, D. VENKATESWARA RAO.
January 10, 1947.

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ZARATITE IN THE NUASAHI CHROME-ORE

THE presence of *Zaratite*, a carbonate of nickel, in chrome-ore has not so far been recorded from any of the chromite deposits of India, *viz.*, the Singhbhum, the Baluchistan, the Mysore and the Madras deposits. The chromite deposit recently discovered at Nuasahi (21° 17′; 86° 20′) in Keonjhar State has revealed its presence.

It is grass-green in colour and earthly in appearance. Seen under the microscope, it is highly pleochroic from green to yellow and has a high refractive index and a high birefringence. It is uniaxial, negative.

The mineral occurs in the inter-spaces between the chromite grains. Further it not only fills in the cracks in the chromite grains but rarely shows some sort of a graphic texture with it. Occasionally it is entirely enclosed in chromite.

The chemical formula for the mineral, according to Dana, is $NiCO_3\ 2Ni(OH)_2\ 4H_2O$ (?). The Indian mineral has not been individually analysed but chrome-ore, containing this mineral alone analysed 0·3 per cent. nickel and 0·6 per cent. cobalt and 1·8 per cent. water (including moisture). Nickel seems to have been partly replaced by cobalt in the present mineral.

Phillips[1] had ascribed the presence of zaratite in the Shetland chrome-ore to the weathering of traces of nickel originally present in the chromite itself or in a nickeliferous olivine.

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December 6, 1946.

1. *Q. J. G. S.*, **83**, 645.

MALE-FERNS OF KASHMIR

MALE-FERN is one of the oldest anthelmentic drugs known and was used by the ancient physicians, Pliny and Galen. It is administered in the form of extract filixmas for eradicating tape-worm infection in man and livestock.

The British Pharmacopœial Drug is derived from the rhizomes and frond bases of *Dryopteris filimax* (Linn.) Schott., a fern indigenous to Great Britain. It should be used within one year of the date of its collection. In America *D. marginalis* A. Gray, which is found in Eastern and Central United States and North to Prince Edward Island forms the source of American Male-fern.

D. filixmas and *D. marginalis* are not indigenous to India but the other ferns belonging to the *Dryoptoris* (Lastrea) *filimaxas* complex grow wild in the Himalayas in general and in the mountainous ranges of Kashmir in particular. These ferns are:—
Dryopteris rasthorni (Diels.) C. chr.; *D. blandfordii* (Hope) C. chr.; *D. odontoloma* (Moore) C.chr.; *D. ramosa* (Hope) C.chr.; and *D. marginata* (Wall.) Christ.

Considerable quantities of the male-fern extract are annually imported into India for medicinal purposes. In order to study if the

Analytical Data of Ferns. D. odontoloma *and* D. marginata

Species	Locality	Calcium oxalate crystals	Percentage of total ash	Percentage of acid insoluble ash	Percentage of *Filicin* in the rhizomes	Percentage of *Extractive*	Percentage of Filicin in the extractive	Remarks
D. ODONTOLOMA	Gandherbal.	Absent.	3·6	0·51	2·8	10·9	25·6	Up to B. P. & U.S.P. standards.
	Pehlgam.	Do.	3·8	0·87	2·3	11·7	19 6	The fern is up to B.P. & U. S. P. standard but the extract falls short of the standard.
	Dosian.	Do.	3·2	0·44	3·1	11·4	27·1	Up to B. P. & U.S.P. standard.
	Bhedi.	Do.	3·1	0·92	2·5	9·4	26·5	Do.
	Patot.	Do.	4·2	0·78	2 1	7·9	26·5	Do.
D. MARGINATA	Tanmarg	Do.	2·9	0·34	3·03	10·9	28·4	Up to B. P. & U.S.P. standard.
	B.P. 1932. Limits.	Do.	Not more than 6%	Not more than 2%	—	—	24–26% W/W	
	U.S·P. XII Limits*	—	—	Not more than 3%	Not less than 1·5%	—	Not less than 24% W/W	

N.B.—The methods of B.P. 1932 have been used for the assay of the drug and all the calculations have been done on the basis of the drug dried at 100° C.

above-mentioned ferns growing wild here can be substituted in place of the official ferns and can be used in the manufacture of the expansive male-fern extract imported from abroad, samples of these ferns were collected for this study.

D. odontoloma occurs widely in the fir zones forests as an undergrowth throughout the Kashmir Valley. It is more common on the southern aspect of the forests retaining good moisture at altitudes of 5,000 to 8,500 feet above sea-level.

D. marginata is found at places with comparatively less moisture in the *Pinus excelsa* zone at altitude of 5,500 to 6,500 feet.

Five samples of *D. odontoloma* and one of *D. marginata* was collected from the various localities in Kashmir. All the tests given in the B.P. 1932, and the U.S.P. XII were conducted and the results are given in the table above.

From the perusal of the above results it is apparent that the local ferns are of B.P. and U.S.P. standard and can yield the male-fern extract of B.P. standard for medicinal purposes.

The other ferns of *D. filixmas* complex are under study and their results will be reported in due course.

We have much pleasure in acknowledging the help and advice we have received from Colonel Sir R. N. Chopra, KT., C.I.E., I.M.S.(r.), during the course of this investigation.

The Drug Research Laboratory, Jammu Tawi,
January 6, 1947.

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A NOTE ON THE CHEMICAL INVESTIGATION OF THE FRUITS OF *CELASTRUS PANICULATA*, WILLD. (*N.O. CELASTRACEAE*)

IN view of a recent paper by Bhargava[1] on the chemical examination of the unsaponifiable matter of the fat from the fleshy arils of *Celastrus paniculata*, we are giving below our findings on the same investigation which was completed two years back.

Bhargava[1] reports the analysis of the fleshy arils of *Celastrus paniculata*. He has isolated a phytosterol (m.p. 142°) and states that it is quite different from the phytosterol isolated by Warsi.[2]

We have extracted the arils with acetone when an orange-red semi-solid fat was obtained. The fat was analysed and the composition of the mixed acids of the fat has been found to be similar to the one reported by Gunde and Hilditch.[3]

The unsaponifiable matter was obtained as a sticky orange coloured mass. During purification the orange colour was bleached. The colouring matter appears to be unstable and could not be isolated. After several crystallisations from 95 per cent. alcohol and finally from petroleum ether a white crystalline material was obtained (m.p. 75° and molecular weight 352) (Rast's method). (Found: C, 81·3; H, 13·7; $C_{24}H_{50}O$ requires C, 81·36; H, 41·1 per cent.) It gave an acetyl derivative (m.p. 57°). It is evidently tetracosanol (m.p. 76·5-77°·5), aceteate (m.p. 57°; *cf.* Brigal and Fuchs[4]). The

residue from mother liquors from tetracosanol, on complete removal of the solvent, was dissolved in acetic acid when a crystalline mass was obtained. It was recrystallised from dioxan followed by alcohol when it was obtained in flakes (m.p. 149°). It gave all the colour reactions of phytosterols.

Bhargava[1] gives the melting-point of the sterol as 142° and has named this sterol as '*Celasterol*'. However, Gisvold[5] has isolated a pigment from the outer bark of the *Celastrus scandeus* and named it '*Celastrol*'.

In naming a new substance care must be taken to see that the same name has not been used for another substance before. Since the name celastrol has been already given to the pigment isolated from a similar plant, some other name ought to be proposed for the sterol isolated by Bhargava.[2]

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January 8, 1947.

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CICADELLA VIRIDIS ITS SYMBIOTES AND THEIR FUNCTION

Cicadella viridis was first investigated by Buchner[1] cytologically while Resühr[2] confirmed Buchner's findings working in an institute of microbiology. There are two types of tumours or rather of bacteriotomes. There is a larger greenish yellow in colour and a smaller which is faintly orange in the female but distinctly so in the male. It has not been remarked by previous workers that the ventral surface of the male insect is orange like the colour of its small tumour. It has been observed that the small and the large tumours are separate morphologically. However in the young stage the small or the orange tumour appears like a protuberance of the large or the yellow bacteriotome. It has been explained by me[3] that both contain bacteria and that in the smaller one the red bacterium predominates and in the major tumour a bacterium which produces an olive green pigment.

However according to Buchner only the smaller tumour contains bacteria. As found infecting the egg the germs have been illustrated on p. 138, in his Fig. 19; they are represented as large-sized bacteria as well as relatively small ones. Since bacteria exhibit polymorphism the difference in size can be explained as such.

A cell from the smaller tumour infected with bacteria is illustrated by Buchner in his Fig. 18, which is reproduced here as Fig. 1. The picture shows long threads, indicated by me as *R* for these bacteria produce a red pigment, and smaller bacteria tending to be mere dots, marked by me as *G*, for they produce in old cultures an olive green pigment. As previously[3] mentioned the yellow green bacterium supports the red commensal bacterium so that it is impossible for the long bacterium to form pure colonies in insect tissue; Buchner's Fig. 1 thus represents a mixed colony with the long bacterium predominating as it does in the smaller or the orange coloured tumour. The

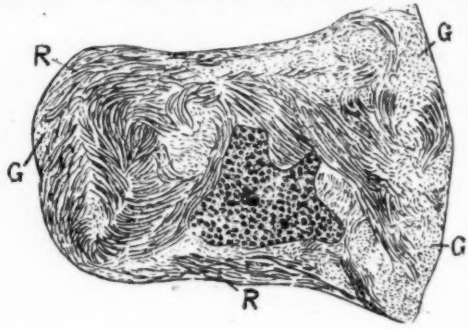
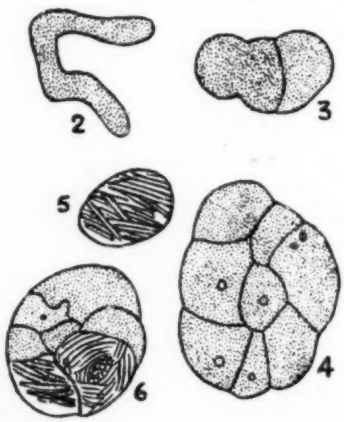


FIG. 1

longer bacterium produces B carotin which gives the small bacteriotome of the male insect its colour; the same pigment appears on its ventral surface and on its legs. In the female this provitamin is reduced to vitamin A and hence its smaller bacteriotome is pale and the dominating colour is that due to the pigment of the other bacterium which forms a green yellow pigment. This accounts for the absence of an orange colour in the small tumour of the female and on its ventral body surface. The male is rich in carotin and is more pigmented, the female is rich in vitamin A and is paler.

As investigated by Buchner and by Resühr the major tumour of *C. viridis* contains a species of what has been called cicadomyces by Sulc. Fig. 2 here is derived from Buchner and



FIGS. 2–6

represents a cell of such a mysterious microorganism. The same germ as seen infecting the egg is entirely different in shape; it becomes rounded as in Fig. 3; it may even form a ball of cell as in Fig. 4; all being derived from Buchner. In Figs. 2 and 3 there is no

nucleus or a vacuole, structures always present in yeasts and in fungus mycelium which should have justified the existence of a species of cicadomyces. In Fig. 4 on the contrary, nuclei-like bodies are vaguely indicated. Fig. 5 shows bacteria inclosed in a round body whose nature has not been indicated. Fig. 6 clearly shows a ball of cells the upper five of them being similar to Fig. 4 while the lower two cells in Fig. 6 resemble Fig. 5 which also contains bacteria. From a pure morphological standpoint Fig. 6 is an anomaly. What we actually see is that half of Fig. 6 conains bacteria while the rest is supposed to be cicadomyces; in fact Fig. 4 represents a ball of degenerate epithelial cells while Fig. 6 a similar group with two cells infected with bacteria. Fig. 1 represents protoplasmic piece of such cell attacked by germs and accounts for the absence of a nucleus or a vocuole.

When yeasts or bacteria, even those living in symbiosis, are smeared and the slide treated with pepsin and hydrochloric acid they resist digestion, while the so-called cicadomyces are all attacked as would be expected from tissue debris.

Summarising it may be said that attention has been drawn that males and females of *Cicadella viridis* differ in colour which also applies to their small tumours. The colour is due to bacteria of which there are two species and the different shades of colour in tumours and on insect bodies can be produced *in vitro* by varying the preponderance of one over the other germ. Cultures producing a green yellow pigment and B carotin pigment have been deposited[4] with the Lister Institute in England.

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February 8, 1947.

1. *Zeit. f. Morph. u. Oek.*, 1925, **4**, 136–8. 2. *Arch. Mikrobiol.*, 1938, **9**, 31. 3. *Curr. Sci.*, 1940, **9**, 495. 4. *Nature*, 1946, 13th July.

ALKALINE PHOSPHATASE IN ERYTHROCYTES

ALKALINE phosphatase has been shown to be present in serum and in various tissues such as bone, kidney, intestines, liver, etc. The determination of serum alkaline phosphatase has been utilized for diagnostic purposes, especially in rickets (Barnes and Carpenter, 1937). Recent work on experimental rickets by Dikshit and Patwardhan (1946) has raised some doubt regarding the current views about the osseous origin of the serum alkaline phosphatase. These authors could not find in rachitic dogs any correlation between the severity of rickets and the serum alkaline phosphatase values, an observation which they (1947, in press) subsequently confirmed in rachitic rats. Although Bodansky (1939) has suggested that the serum phosphatase represents the sum total of phosphatase contributed by different tissues, it was felt that a search for phosphatase in a tissue which is in close equilibrium with serum was warranted, and hence the possibility of the existence of an alkaline phosphatase in erythrocytes was investigated.

Roche and Bullinger (1939) reported the presence of an alkaline phosphatase in hæmolysed cells of the horse with an optimum activity at pH 9·2-9·5. Behrendt (1943) working with the hæmolysates of human blood failed to obtain a zone of activity at pH 9 although he found the enzyme active in the acid zone of pH 5. With the exception of Roche and Bullinger's report (*loc. cit.*) no mention is found in the literature concerning erythrocyte alkaline phosphatase.

The present authors have worked with the blood of albino rat, guinea-pig, sheep and man and they are convinced that the erythrocytes normally contain an alkaline phosphatase. The oxalated blood was centrifuged and washed with 0·9 per cent. NaCl solution four to five times on the centrifuge. Every time when the supernatant fluid was being removed the buff layer of leucocytes was also pipetted out. At the end of four or five such treatments practically no leucocytes must have remained in the packed cell mass. The cells were then hæmolysed by the addition of a mixture of alcohol and water (6 : 4). The proteins were precipitated by addition of chloroform and vigorous shaking. A water-clear upper layer was obtained which was carefully pipetted off after centrifuging the mixture. The enzyme was found dissolved in the aqueous layer. Sodium glycerophosphate at pH 9·3 (Veronal-acetate-HCl buffer) at 37° C. was used as substrate. Comparable experiments were carried out at pH 5·3. The results are given in Table I.

TABLE I

Erythrocytes	Mg. inorganic P liberated in 24 hours per 100 ml. of red blood cells	
	At pH 9·3	At pH 5·3
Albino rat ..	52	Nil
	62	Nil
	68	Nil
	60	Nil
Guinea pig ..	125	2·4
	69	1·6
Sheep ..	47	—
	31	Nil
	51	—
	63	14.6
Man ..	17	1·6
	23	—

It is concluded from the above experiments that in the four species of animals studied, the erythrocytes contain a phosphatase which is active at pH 9·3. It should be mentioned, however, that the enzyme is weak and has a relatively lower activity compared with that present in the plasma.

Further work on the problem is in progress

and will form the subject of a detailed communication elsewhere.

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Nutrition Research Laboratories,
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February 12, 1947.

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NIOBOTARTARIC ACID

IT is known that freshly precipitated niobic and tantalic acids dissolve in solutions of organic acids like oxalic, tartaric, etc., resulting in the formation of complexes. The oxalate complexes have been investigated by Russ,[1] who also prepared a number of alkali nioboxalates. Edmister and Albritton[2] have furnished evidence for the formation of a complex of niobium with tartaric acid and also have reported a tartracolumbic acid; but its structure has not been confirmed and its salts have not been prepared. It was, therefore, proposed to study the complexes of niobium and tantalum with organic acids in greater detail.

Freshly precipitated niobic acid prepared from specially purified niobium pentoxide, was dissolved in hot aqueous tartaric acid. After filtering off undissolved niobic acid, the clear solution was concentrated and the niobotartaric acid crystallised with the addition of alcohol. The crystals were washed with dil. alcohol, dried and analysed. Niobium was determined by precipitating it from a solution of the sample and subsequent ignition and weighing as Nb_2O_5. Tartaric acid was estimated by the Goldenberg method.[3] The crystals were also titrated with standard alkali using phenolphthalene as indicator. The results of the analysis bear out the meta composition, i.e., $Nb_2O_5 : 2(C_4H_6O_6)$ for the niobotartaric acid formed. The sodium salt of this acid was also prepared by treating various sodiumniobates with tartaric acid. Further work on the complex acid and its structure is in progress by application of physical methods.

The author's thanks are due to Sir J. C. Ghosh and Dr. M. V. C. Sastri for kind encouragement.

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February 14, 1947.

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A NOTE ON THE OCCURRENCE OF THE MITE-*PARATETRANYCHUHUS INDICUS* H. ON JOWAR(*ANDROPOGON SORGHUM*) AND ITS PREDATORS IN MYSORE

IN the issue of *Current Science*, No. 7, July 1946, pp. 186-87, Haroon Khan, M., and Bhatia, S. C., have recorded the occurrence of the mite —*Paratetranychus indicus* H., and its effective predator *Scymnus gracialis* M., on sugarcane at Sakrand (Sind) which they came across while making a survey of crop pests there. They have described the severity of the mite pest and how it was checked by the predator.

Ramakrishna Iyer, T. V., has mentioned in his *Handbook of Economic Entomology for South India, Paratetranychus indicus* H., as one of the minor pests of *jola* in some areas; and *Scymnus coccivora* R., as a predator on *Pulvinara maxima*—the Nim scale in Coimbatore. Lefroy has stated in *Indian Insect Life* that *Scymnus xerampelinus* M., and *Scymnus nubilans* M., are commonly found feeding on cotton aphis and cotton mealy bug. In Mysore, the occurrence of this mite and its predators have now been noted for the first time.

During 1946 (July-September) it was seen that the leaf blades of Jowar in certain parts of Mysore, Mandya and Chitaldroog Districts had turned blood-red. This condition was known by different names—*Chandramaru, Kumkumaroga, Rakthamari, Samberoga, Handiroga*, etc., in different villages.

On examination of the leaf blades the presence of a large number of mites (*Paratetranychus indicus* H.) was made out on every blade that had turned red. It was evident that the reddening of the leaf was due to the work of the mites. All stages of the mites—eggs, nymphs and adults were located generally on the ventral surface of the leaf blades (the presence of the mite was also made out on the dorsal surface of some). Counts taken from a number of infested leaves selected at random showed an average of 182 per square inch. This figure is sufficient to indicate that the incidence was quite severe. In patches of severe infestation the entire stalk of the plant had become dry and pithy and the development of grains was arrested; earheads too had become dry; some of the grains had also turned reddish.

Two kinds of predator beetles, *Scymnus* sp., were found actively feeding on the mites. One was a tiny black oval-shaped beetle and was perdominant in numbers. Both the larval grub and the adult were found to be feeding on this mite. The grub was found to actively chase the mite and when near dart at it to clutch it by its mandibles. It is transparent and full of warts and rows of short hairs on the tubercles. Pupæ were seen on the leaf, attached by the caudal end. The adult beetle is uniformly black, the elytra being finely pubescent all over. The head region is tucked under, and cannot be made out and only the thoracic area is clearly seen.

The other beetle is bigger, brown in colour with a dark shade on the thorax and of the upper portion of the abdomen, the shade des-

cending narrowly in the centre of the elytra. The entire body is covered with fine pubescence. Both the grubs and the adults of these two Coccinellid beetles are effective predators on the mites.

I am grateful to Mr. B. Krishnamurti, Entomologist, for his kind suggestions and guidance in preparing this note.

Entomological Laboratory,
Department of Agriculture,
Bangalore, M. PUTTA RUDRIAH.
January 9, 1947.

1. Kapoor, A. P., *Ind. J. Ent.*, 1942, **4**, 49-66. 2. Rahman, K. A., and Sapra, A. N., *Ind. J. Ent.*, 1910, **2**, 201-12. 3. Haroon Khan, M., and Bhatia, S. C., *Curr. Sci.*, July 1946, No. 7, 186-7. 4. Ramakrishna Iyer, T. V., Hand Book of *Eco. Ent. for South India*, pp. 63-113. 5. Maxwell-Lefory, H., *Indian Insect Life*, 307. 6. Quayle, Henry J., *Insects of Citrus and other Subtropical Fruits.*

A NEW RACE OF *PUCCINIA GRAMINIS TRITICI* AND TWO BIOTYPES OF RACE 42

DURING the course of the work on testing the reactions of wheat varieties and hybrids to black stem rust caused by *Puccinia graminis tritici* carried out at Mahabaleshwar, it was observed that certain varieties of wheat which were highly or moderately resistant to seven races of black rust found in India, *viz.*, 15, 21, 24, 34, 40, 42 and 75, in the seedling tests, developed large and healthy pustules when tested for mature plant resistance in the field. The presence of a new race or races in natural infection was suspected. Accordingly, isolations were made from some of these pustules, and the inoculum was multiplied separately on a susceptible variety of wheat grown in the glasshouse. The pathogenicity of the field isolates was tested on the wheats on which these were originally collected and ultimately pure cultures of three isolates were established.

These three isolates were tested on the differential wheat varieties and the reactions of the latter are described as under :—

(1) One of the isolates produced reactions on the differentials of an entirely different type from the reactions produced by any one of 189 races of black stem rust described by Stakman *et al.*[1] This isolate is, however, similar to race 119 of black rust except for its reactions on Kaphli, which is highly resistant (1-type infection) to race 119 but is moderately susceptible (3 to 4-type infection) to the new race under the conditions of light and temperature obtainable in the cold season at Mahabaleshwar. The reactions produced on the standard differentials by the new race of black rust, the material of which is being submitted to Dr. E. C. Stakman for comparative tests with race 119 under controlled conditions, are given in Table I.

TABLE I

Infection types produced by the new race and race 119 *of* P. graminis tritici *on differential wheat varieties*

Physiologic race	Reactions of differential varieties											
	Little Club	Marquis	Reliance	Kota	Arnautka	Mindum	Spelnar	Kubanka	Acme	Einkorn	Vernal	Khapli
New race	4	×	0;	0;	4	4	4	4	4	3–4	3–4	3–1
‡Race 119	4	×	0	0;	4	4	4	4	1–	3+	3+	1–

‡ Infection types as reported by Stakman *et al.*

(2) The other two isolates, when tested on the differentials, proved to be race 42 of black rust, but were found, on further tests on other wheat varieties, to be biotypes of this race. One of the biotypes, *viz.*, race 42A, produced type 4 infection on Khapli, whilst, under similar conditions of light and temperature at Mahabaleshwar, race 42, the material of which was originally obtained from the Rust Research Laboratory at Simla, produced type 3 infection. This biotype is more virulent on Khapli than race 42 or its other biotype, *viz.*, race 42B, and can easily be distinguished from the two latter when Khapli plants infected with these are placed side by side. Biotype 42B is, however, similar to race 42 in its reactions on Khapli but can easily be distinguished from the latter by its reactions on other wheats. Both the biotypes of race 42 were found in natural infection at Mahabaleshwar during 1944-45 and 1945-46 seasons. Comparative reactions of race 42 and its two biotypes on some wheat varieties are given in Table II.

TABLE II

Comparative reactions of some wheat varieties to race 42 *and its biotypes*

Wheat variety	Race 42	Biotype 42 A	Biotype 42 B
Khapli C. I. 4013 (Standard differential)	3	4	3
*Ex 3	2-3	3	4
*C. 6014	0;–2	2	3
*C. 14098	0;	2	4
*E. 220	0;	2	3+
**Hofed 1	0;	2	3+

* Wheat varieties received from the Wheat Specialist, C.P. and Berar.

** Wheat variety received from the Cereal Breeding Station, Nphad, Bombay Province.

College of Agriculture, B. N. UPPAL.
Poona, V. P. GOKHALE.
December 13, 1946.

1. Stakman, E. C., M. N. Levine and W. Q. Loegering *Sci. Jour. Ser. Minn. Agric. Expt. Sta.*, 1944, Paper No. 2148.

THE EFFECT OF LONG PERIODS OF DARKNESS ON FLOWERING IN *SACCHARUM SPONTANEUM* SORAPARAI, 270

IN a previous note[1] a few photoperiodic treatments were suggested for inducing flowering and controlling the times of flowering in sugarcane varieties. One of these treatments, which enabled us to induce flowering in non-flowering wild form *Saccharum spontaneum* Burma, consisted in daily subjecting the potted top-halves of this variety to 22 hours darkness for a period of two months prior to the commencement of the flowering season. Recently similar darkness treatments were tried on another type of *Saccharum spontaneum*, *viz.*, S.s. Soraparai, 270, and some very interesting results were obtained which seem worthy of mention.

Top portions, removed from six months old plants of the variety S.s. Soraparai, 270, growing under field conditions were used for this study. These were planted upright in medium-sized pots, one in each pot, containing the ordinary garden-land soil. About a month after planting, *i.e.*, when the tops had just resumed growth, the pots were divided into five series, of five pots each, and were subjected to the following five treatments :—

(1) Normal daylight.
(2) Two-hour day only—from 12 noon to 2 p.m.—for a period of 15 days from 10th September to 10th October.
(3) Two-hours day only—from 12 noon to 2 p.m.—for a period of 30 days, from 10th September to 10th October.
(4) Two-hours day only, for a period of 45 days from 10th September to 25th October.
(5) Two-hours day only, for a period of 60 days from 10th September to 10th November.

Results.—This variety came to flower on 30th November with the first treatment above (Fig. 1). It flowered on 10th December with the second treatment; on 2nd January with the third treatment; on 9th January with the fourth treatment and on 11th February with the last mentioned treatment, *i.e.*, showing a delay of about 75 days in the time of flowering as compared to the tops kept throughout under normal day-length conditions.

The intensity of flowering declined from 100 per cent. with the first treatment to 20 per cent. with the last treatment, i.e., when subjected to two-hours day for a period of two months.

Normal day light	Daily 22 hours darkness for a period of 15 days	Daily 22 hours darkness for a period of 30 days	Daily 22 hours darkness for a period of 45 days	Daily 22 hours darkness for a period of 60 days

FIG. Showing the effect of long periods of darkness on flowering in potted tops of the variety *Saccharum Spontaneum* Soraparai, 270

Thus, with the above treatments it has been possible to make available the arrows of the variety S.s. Soraparai, 270, for hybridisation work, throughout the flowering season.

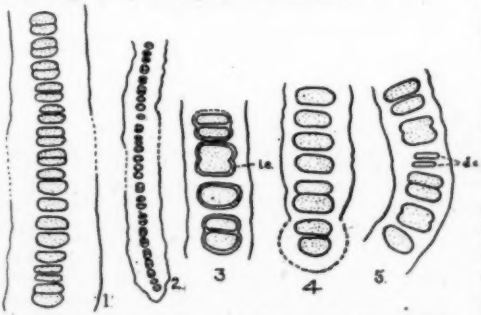
The author is indebted to Mr. N. L. Dutt for his keen interest and guidance during these investigations.

Imperial Sugarcane Breeding Station,
Coimbatore, N. D. YUSUF.
December 16, 1946.

1. Yusuf, N. D., and Dutt, N. L., *Curr. Sci.*, Nov. 1945.

OCCURRENCE OF *JOHANNESBAPTISTIA* IN THE ADAYAR RIVER, MADRAS

THE writer read with interest the paper[3] on *Johannesbaptistia pellucida* (Dickie) Taylor and Drouet[2] collected from a brackish water pool at Ennore, Madras. It is considered to have not been recorded from elsewhere in India. The present alga, however, was found in a huge collection of algæ made by the writer from the Adayar river, Madras. The Adayar alga agrees with the Ennore one in all details regarding structure and development (Text-Fig. 1-5) except in dimensions.



TEXT-FIGS. 1-5. *Johannesbaptistia pellucida* (Dickie) Taylor and Drouet.

Figs. 1 and 2. Portions of filaments with the diffluent margins of the sheath shown in dotted lines. Fig. 3. Portion of a filament showing the individual envelopes of the cells in acommon mucilage. Fig. 4. End portion of a filament with a two-celled fragment (shown in dotted line) in the stage of dislodgement from the end. Fig. 5. Portion of a filament with two dead cells (*i.e.*, individual envelope; *d.c.*, dead cells). Fig. 1, × 1,200; Fig. 2, × 550; Figs. 3-5, × 1,650.

The dimensions of the filaments and cells of the Ennore alga were compared[3] with those given by Drouet[1] for *Johannesbaptistia pellucida* (Dickie) Taylor and Drouet (filament 8-23 μ broad and cells 4-17·5 μ broad and 2-6 μ long) and they come within the range of these dimensions. The dimensions of the present alga also accord with those given by Drouet.

	Ennore alga	Adayar alga
Long. fil. ..	400-2,500 μ	Up to 1,000 μ
Lat. fil. ..	7·9-9·2 (10·8) μ	11·4-15·2 (22·8) μ
Lat. cell. ..	3·9-5·2 μ	5·8-8·3 (9·5) μ
Kong. cell. ..	2·6-3·9 μ	2·4-4·0 (4·8) μ
Crass vag. ..	—	2·6-6·4 μ

This alga is, therefore, referred to *Johannesbaptistia pellucida* (Dickie) Taylor and Drouet, though possessing broader cells and thicker sheath than those of the Ennore one.

The writer is grateful to Dr. F. W. Jane, PH.D., D.SC. (Lond.), and Professor V. Bharadwaja, M.SC., PH.D. (Lond.), F.L.S., for their very kind interest in the preparation of this note.

Teachers' College,
Saidapet,
Madras,
University College,
London,
November 25, 1946.

C. BHASHYAKARLA RAO.

1. Drouet, F., "Myxophyceæ of the G. Allan Hancock Expedition, 1934, collected by Wm. R. Taylor", *The Hancock Pacific Expedition*, 1936, **3**, (2), 15-30. 2. —, "Notes on Myxophyceæ, i-iv," *Bull. Torrey Bot. Club.*, 1938, **65**, 285-92. 3. Iyengar, M. O. P., and Desikachary, T. V., "On *Johannesbaptistia pellucida* (Dickie) Taylor and Drouet from Madras," *Journ. Ind. Bot. Soc.*, 1946, **25**, No. 3, 117-21.

POLYELECTRONS

In an interesting article which appeared in the *Annals of the New York Academy of Sciences* (1946, **48**, 219-38), Dr. Wheeler presents theoretical evidence for the existence of entities composed entirely of electrons and positrons together with a discussion of their properties. The simplest of these entities consists of one electron and one positron, bound together in a structure similar to that of the hydrogen atom. It has a life time of $1{\cdot}24 \times 10^{-10}$ sec., when the spins of the two particles are parallel, and a life several orders of magnitude greater, when the spins are anti-parallel. The next higher entity is composed of two positrons and one electron or of two electrons and one positron. It has a mean life of the order of 10^{-10} sec. The probability of production of a bi-electron by the interaction of an energetic gamma-ray with the field of force of an atomic nucleus is shown to be less than 10^{-6} of that for production of an electron-positron pair. The article contains a discussion of the similarities and distinct differences between polyelectrons and cosmic rays mesons.

REVIEWS

Principles of Fruit Preservation. By T. Nn Morris. (Chapman & Hall, Ltd., London), 1946. Pp. xiii + 198. Price 18*sh.*

This second edition of Mr. Morris's well-known book has appeared some thirteen years after the first. During this period, important advances have been made in the technology and underlying sciences of the fruit preservation industry. As such, one would have expected a considerable amount of revision of the earlier edition. This, however, has not been the case although a few sections have been re-written and two new chapters added, one on candied fruits and the other on fruit juices. Thus, with very few exceptions, the references to literature cited date beyond ten years. Notable developments such as those relating to pectinic acids, steam-blanching before drying and freeze-drying, receive bare mention, sometimes only as footnotes, while comparatively older contributions are often discussed in detail as for example in the chapters on pectin-sugar-acid gels and spoilage of canned foods. It is disappointing to find no reference in a monograph of this kind to subjects such as gas storage and gas maturation, utilization and disposal of fruit wastes, or production of fruit wines and fruit vinegar. There is also the feeling that the chapters on discoloration in fruit products and vitamins in preserved fruits could have been brought closer to date with citations to recent sources. Again, some mention could well have been made to the use of firming agents, chemical preservatives and colours in various fruit processing operations.

As the title of the book indicates, the application of the fundamental sciences to the manufacturing processes concerned are given prominence but one wonders why several of the drying methods are described at great length. Perhaps a corresponding account of the mechanical systems of basic operations in canning, jam making, fruit juice bottling and quick freezing would have added considerably to the value of the book.

A feature of the book is the inclusion, in outline, of analytical methods for examination of processed fruits but these are neither adequate nor complete to be of value in the routine examination and chemical control of manufactured fruit products.

The foregoing criticisms must not be allowed to detract from the value of this publication. It is an outcome of much first-hand experience and careful thought has clearly been given to providing a simple, accurate and readable presentation, with many practical hints, of the principles of jam and jelly manufacture, fruit canning and fruit dehydration. As a working manual, it will certainly become as widely known and used as its earlier edition.

A. SREENIVASAN.

Controlled Atmospheres for the Heat Treatment of Metals. By Ivor Jenkins. (Chapman & Hall, London), 1946. Pp. 533. Price 50*sh.*

The book carries its hallmark of virtue on its first few pages in the shape of a foreword by no less a scientist than Dr. C. J. Smithells.

The author has, according to his preface, sought to bridge the gap between the theoretical and the practical aspects of the subject and to promote a more general recognition of the principles underlying a controlled atmosphere process. His efforts have met with unqualified success.

In the first edition of the book a brief survey is made of the historical development of controlled atmospheres in industry and this is followed by a discussion on the chemical equilibria of both inter-gas and gas-metal reactions.

Ammonia and its derivatives, hydrocarbon gases, charcoal gas and miscellaneous controlled atmospheres are dealt with—in successive chapters.

The middle section of the book is devoted mainly to the methods of removal of carbon dioxide, sulphur gases and water vapour from heaf treatment atmosphere and concludes with a chapter on gas analysis.

In the third and last section attention is given to the industrial applications of controlled amospheres. The heat-treating of low carbon, high carbon and alloy steels is considered as well as the process of carburising and nitriding. The section concludes with a chapter dealing with the heat-treatment of non-ferrous alloys and metals.

It is impracticable to give in the space available a more detailed summary of the subject-matter contained in the 500 odd pages of this volume but a few of the reader's impressions may not be out of place.

One's sympathy goes out to the heat-treater of steel in his efforts to steer clear of the "Devil" of decarburisation and the "Deep blue sea" of oxidation. Inter-gas reactions, at high temperatures, between the various constituents of such a complicated mixture as town's gas—should provide congenial activity for readers with a taste for solving puzzles. A steel heat-treater has often the difficult task of utilising successfully an atmosphere which is both complex and variable in composition. These trouble raisers are avoided when ammonia or its derivatives are employed but the relatively high costs preclude their use in many commercial operations. Besides, precautions must be taken against the toxic qualities of ammonia and the explosive nature of a wide range of cracked ammonia-air mixtures.

The fact that the publishers have conformed to authorised economy standards seems to have had little detrimental effect on this attractively produced volume. Both text and the 268 figures (many of the latter being photographic reproductions) are as clear as one could wish.

Lastly, the author's style is simple and lucid, mathematics is kept in hand, the book contains many references and is well served with name and subject indexes.

The great expectations raised by the Dr. Smithell's foreword are amply realised and Dr. Jenkin's book should be found in the library of any undertaking which heat-treats metals and alloys.

FRANK ADCOCK.

The Methods of Plane Projective Geometry based on the Use of General Homogeneous Co-ordinates. By E. A. Maxwell. (Cambridge University Press), 1946. Pp. 230. Price 12*sh.* 6*d.* net.

The number of available books on the analytical geometry of conic sections is so large that one would naturally ask for himself whether it is worth while going through one more treatise on the subject. But the present book is really a welcome addition. Whether one agrees or not with the arrangement and the method of treatment adopted by the author, the book is interesting reading. The treatment of the chapters "One-One Algebraic Correspondence" and "Cross-Ratio and Harmonic Ranges" is very satisfactory from the algebraic point of view, and one will feel sorry that the same exhaustive treatment is not kept up, and that important subjects such as the invariants of two conics are not touched. The author, it is true, plainly says that his book "is written as a study of *methods* and not as a catalogue of theorems" and hopes "that a student reading it will have nothing to unlearn as he proceeds to apply these methods to study the geometry of figures in three dimensions or in higher space". But the treatment of the subject is so refreshing that we cannot help wishing for some more of these methods, and a more exhaustive treatment of many chapters would not have reduced the book to a catalogue of theorems. This is not a criticism against the book, but the reviewer feels that this is the best compliment that can be given for the book. In contrast with the above, the examples in the book are numerous and varied in character, and form a regular catalogue. Many of them are taken from various recent examinations, and hence provide welcome additions to the well-known stereotyped problems available in all books. The book can be strongly recommended to the student and to the teacher of the subject.

C. N. S.

Lymph. By Philip D. McMaster, Robert Chambers, Eliot A. Clark, Thomas F. Dougherty, Cecil K. Drinker, William E. Ehrich, Eugene M. Abraham White and B. W. Zweifach. (Published in the *Annals of the New York Academy of Sciences*, Vol. XLVI, Art. 8, pp. 679-882).

This volume contains an interesting series of original articles on the physiology of lymph. The first two articles contain an account of the circulation in the capillaries and related vessels and explain their actions in a more satisfactory manner than hitherto; the contractility of capillaries is brought into line with contractility elsewhere. Capillary permeability is then ably discussed by Landis; larger molecules can escape through the capillary walls more easily than smaller molecules if the equatorial diameter of the former is less than that of the latter. Then interesting experiments are described on lymph formation and their bearing on pathological problems elucidated. The functions of the lymphocytes and their relation to immunity is discussed. The researches of Drinker on extravascular protein are likely to have repercussions on the Starling hypothesis and provoke revision of our ideas on the osmotic functions plasma proteins.

INDERJIT SINGH.

GEOMAGNETIC STORMS

Geomagnetic activity during the quarter ending December 1946 was far less marked than during the preceding three quarters. Some details of the geomagnetic disturbances recorded at Alibag Magnetic Observatory are given in the following table in which t_0, t represent time (I.S.T.) of commencement of the storm and its intense phase respectively and T the duration of the intense phase expressed in hours. The ranges in the three different elements (D, H and V) of the earth's magnetic field as recorded at Alibag Magnetic Observatory during the disturbances have also been given, D in minutes of arc, H and V in γ where $1\gamma = 10^{-5}$ gauss. The maximum k-index (k_m, say) recorded during the disturbances have also been given.

Date	t_0	t	T	Range			k_m	Nature of commencement
				D	H	V		
1946	h. m.	h. m.	hrs.	min.	γ	γ		
November 5-6	14 52	11 30 on Nov.6	11½	3·1	138	27	5	Sudden
November 20-22	About 15 30	12 07	8	3·6	165	37	5	Gradual
November 24	9 16	15 25	6	3·4	215	24	6	Sudden

SCIENCE NOTES AND NEWS

FOURTH INTERNATIONAL CONGRESS FOR MICROBIOLOGY

The fourth International Congress for Microbiology will be held in Copenhagen, July 20|26, 1947, under the presidency of Th. Madsen. There will be nine sections: General Microbiology (*Convener*: K. A. Jensen), Medical and Veterinary Bacteriology (H. C. Bendixen), Viruses (J. Orskov), Serology and Immunology (M. Kristensen), Variation and Mutation in Micro-organisms (O. Winge), Plant Pathology and Mycology (N. F. Buchwald), Water and Soil Microbiology (E. Petersen), Dairy and Food Microbiology (E. Olsen), Alcoholic and Other Fermentations (H. Jorgensen). The Secretary, Dr. M. Bjorneboe, may be reached at the Kommunehospitalet, Copenhagen, Denmark.

INTERNATIONAL SOCIETY OF EXPERIMENTAL CYTOLOGY

Members of the Bureau of the International Society for Experimental Cytology met at Copenhagen, July 26|27, 1946. It was decided to reorganize the Society considerably (into an International Society for Cytology and Histology), to make it more permanent and to establish, if possible, a new scientific periodical. Dr. Harald Okkels (University of Copenhagen) and Dr. B. Fell are preparing new statutes, and also considering the relations with the Unions and UNESCO. Another conference, preliminary to the Stockholm Congress (*cf. infra*) will be held in Holland, Easter 1947.

SIXTH INTERNATIONAL CONGRESS ON EXPERIMENTAL CELL RESEARCH

The sixth International Congress on Experimental Cell Research will be held in Stockholm, July 20|26, 1947. The Congress will be organized by a Swedish working committee. J. Runnström, of WennerGrens Institute, will act as Chairman for the Conference, and T. Caspersson and H. Hyden, of the Karolinska Institute, as Secretaries. The Conference will include a series of symposia on problems in experimental cell research from physico-chemical, physiological and morphological aspects.

PACIFIC WAR MEMORIAL

The Pacific War Memorial, established in 1946, after the Pacific Science Conference (Headquarters at 70, Pine St., New York City) proposes to establish throughout the Pacific Ocean area strategically located field stations. These field stations will correspond with many points where Americans died fighting for freedom. In addition the Memorial will initiate a plan for the creation of War Memorial National Parks and Reserves where samples of the unique wild life of the region may be preserved in its natural habitat for the future. The purpose of the field stations is to serve as bases for original exploration, collecting and research in the natural and physical sciences. These stations will furnish equipment and laboratory facilities for visiting scientists as well as a permanent research staff.

CENTRAALBUREAU VOOR SCHIMMELCULTURES

The Centraalbureau voor Schimmelcultures, at Baarn, Neth. (Dir. Joh. Westerdijk), issued its latest catalogue, a 140-page list of some 7,000 fungi and yeasts, in 1943. Copies of this and further information may be obtained from the Bureau which has not been damaged to any extent during the war years.

A MYCOLOGICAL AND PLANT PATHOLOGICAL SOCIETY FOR INDIA

Drs. J. F. Dastur and B. B. Mundkur have sent us the following circular:—

"Several Mycologists and Plant Pathologists have from time to time expressed a desire that a Society of Plant Pathologists and Mycologists for India be formed, following the lines of the Indian Entomological Society and the Society of Indian Plant Breeders and Geneticists. As the number of workers on mycological and plant pathological problems is steadily increasing in India in the Research Institutes, Universities and Colleges of Science and of Agriculture, it has seemed desirable to start a move for founding such a Society.

The primary objective of such a Society would be to advance the study of Mycology and Plant Pathology in India and to publish the work done by Indian Mycologists and Plant Pathologists by issuing a Journal which would include summaries of important papers published abroad, for though plant pathological and applied mycological literature is adequately reviewed in the *Review of Applied Mycology*, articles of purely mycological interest are not abstracted in that Journal. The Society will also strive to be the adviser of the Central and Provincial and State Governments in mycological and plant pathological matters, just as the American Phytopathological Society is doing in the United States of America.

If a fairly good response is received as a result of this appeal, it is proposed to concert measures for founding such a Society during the forthcoming meeting of the Plant Pathological Committee of the Indian Council of Agricultural Research when distinguished Mycologists and Plant Pathologists are expected to be at New Delhi, by calling a meeting for the purpose."

141-47 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for The Current Science Association, Bangalore

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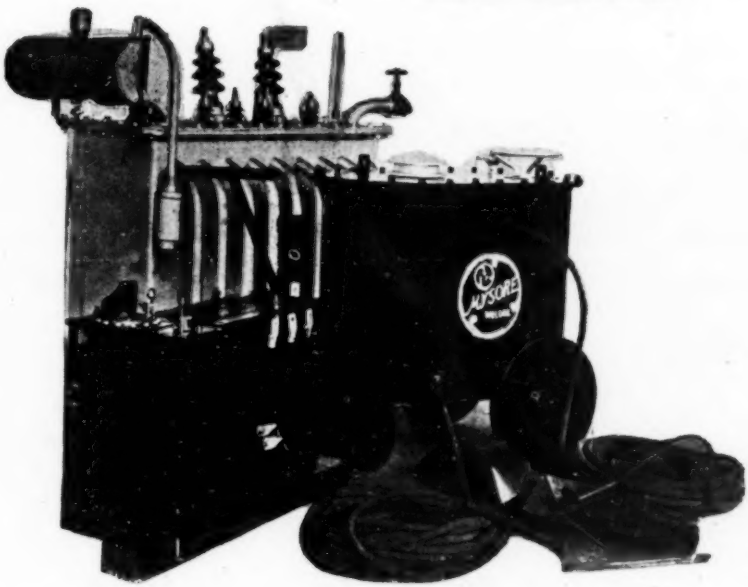

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For 3 Ph. supply wheel regulator in 10 amp. steps. Robust construction and tap switch with all accessories. Complete 200 or 300 amp. 25 & 50 cycles supply.

Manufacturers of transformers upto 500 K.V.A. 33 K.V. to B.S.S. for the last 14 years.

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- **Kipp's Apparatus of one litre capacity.**
- **Desiccators of 4", 5" and 6" diameter.**
- **Measure Glasses of 2 drams, 1 oz., 4 oz. and 8 oz. cap. accurately calibrated.**

and

All Types of Graduated Glassware such as Measuring Flasks, Measuring Cylinders, Burettes, Pipettes, etc., etc.

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Barkometer, English 10″ 0–80% Rs. 17/8 ; Brinometer, Engiish Rs. 9/8 each.

Beakers	100	250	500	1000	2000 c.c.
Indian	-/15/-	1/2	1/11	2/12	
English	2/7	2/11	4/6	5/14	11/14 each

Bottles Reagent flat stopper	4	8	16	32	64	oz.
Indian—Narrow mouth	10/14	14/4	18/8	30	82	per doz.
English ,,	18/14	25/8	35/4	60	192	,,

(*N.B.*—Wide mouth 25% extra ; Extra Wide mouth 75% extra)

Buretttes with stopcock—English 25 c.c. Rs. 11/8 ; 50 c.c. Rs. 13/8 ; 100 c.c. Rs. 16/8 ; Schellback 50 c.c. Rs. 17/8 ; 100 c.c. Rs. 19/8

Butryometers tube—English 8 to 9% as available Rs. 8/12

Desiccator with zinc plate	4″	5″	6″	8″	10″
Indian	8/15	10/6	14/8	39	
English			30	55	84

Dessicator Vacuum—English 8″ Rs. 104

Distilling Apparatus Copper—Capacity	1	2	4	10	20	Gallon
	Rs. 80	104	190	350	550	

Distilling Flask	250	500	1000	2000	3000	5000 c.c.
Indian	3/12	4/7	6/8	10/12		
English	7/15	9/8	14/8	19/8	26	32

Flask Capacity	250 c.c.	500 c.c.	1000 c.c.	2000 c.c.	3000 c.c.	5000 c.c.	10000
Indian	1/2	1/10	2/15	5	10/12	18/8	
English	2/10	4/8	5/14	9/8	14/8	23	38/8

Measuring Cylinder	100 c.c.	250 c.c.	500 c.c.	1000 c.c.	2000 c.c.	
Indian	2/6	3/4	5/8	9/8		Each
English	5	7/6	10/15	15/8	26/8	Each

Measuring Flasks Stoppered	50 or 100 c.c.	250 c.c.	500 c.c.	1000 c.c.	2000 c.c.
Indian	2/3	2/14	4/6	5/13	
English	5/14	7/6	11/8	19/8	24/8

Measure Glass—English 4 oz. 8 oz. 16 oz. Rs. 3/10 ; 4/12 5/12 respectively 20 oz. 7/8 ; 32 oz. 12/8 each.

	1c.c.	2 c.c.	5 c.c.	10 c.c.	25 c.c.	50 c.c.
Pipettes Valumetric Sup. Indian	-/8/-	-/8/-	-/10/-	-/14/-	1/2	1/8
English	1	1/10	1/11	1/15	3/2	4/15
Graduated Sup. Indian	1	1/6	2	2/3	2/8	in 1/10
English	5/4	5/8	6	6/8	7/8	

Separating Funnels English 100 c.c. 12/8 : 250 c.c. 14/12 ; 500 c.c. 21/8 ; 1000 c.c. 28/- ; 2000 c.c. 38/-.

Gum Boots—Indian Rs. 15/8 ; Superior Indian Rs. 19/8 ; English Rs. 39/-.

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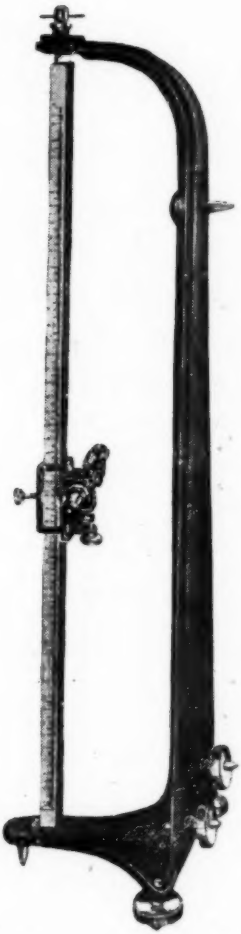
PRECISION CATHETOMETERS

No. 10400



No. 10395

CATHETOMETER
(Simple Pattern)
No. 10400

Designed to provide an accurate instrument at a moderate price. It is lighter in construction and can be used in the vertical position only. The scale is engraved on the vertical rod of 1" cross-section. A vernier reading accurate to 0·05 mm. is attached to the telescope carriage, which moves smoothly along the scale. The telescope is provided with a draw tube for focussing, and is fixed with its axis perpendicular to the scale. The bed is strong and is provided with levelling screws for keeping the scale vertical.

Specification, simple pattern of range
50 cm.
Price: Rs. 250
100 cm.
Rs. 350

NEW PRECISION CATHETOMETER
No. 10395

Indispensable for every college laboratory and useful for measurement of distances between two points which are not accessible. It consists of a telescope with a 7" objective moveable vertically along a scale in mm. with a vernier attachment which can read accurate to ·05 mm. The telescope is adjusted horizontal by a spirit level, and levelling screws are provided in the base of the instrument for adjustment of the scale in the exact vertical position. Rack and pinion is invariably attached to the telescope.

Specification 50 cm.
Price: Rs. 500
100 cm.
Rs. 750

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